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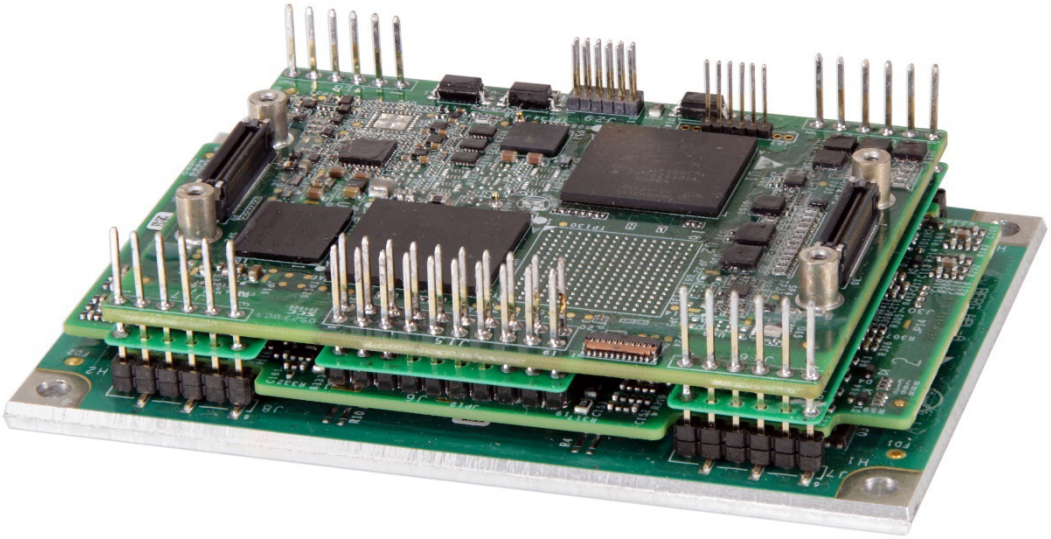
Platinum Quad Digital Servo Drive Installation Guide

EtherCAT



January 2024 (Ver. 3.003)

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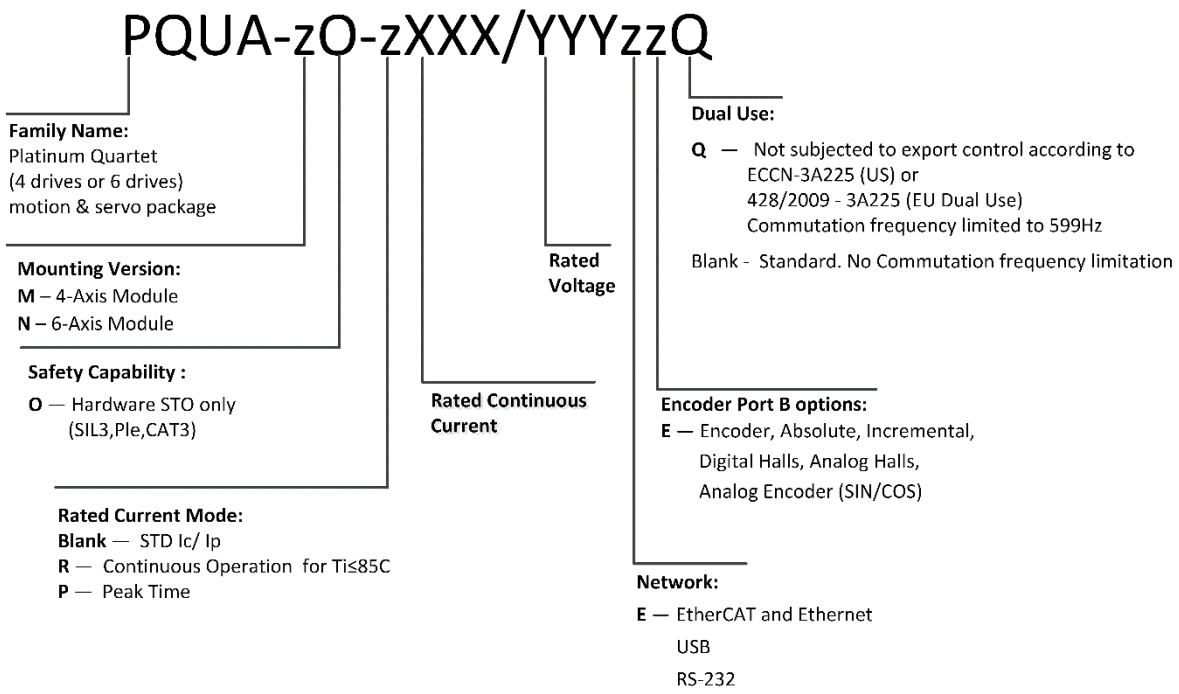
Catalog Number



Revision History

Version	Date	Details	Version	Date	Details
Ver. 1.000	Apr 2020	Initial Release	**Ver. 2.008**	Jan 2023	Updates
Ver. 1.001	July 2020	Various updates	**Ver. 2.007**	Apr 2022	Updates
Ver. 2.000	Oct 2020	Various updates	**Ver. 3.000**	Aug 2023	Updated to include 6 axis modules and new dimension drawing in Chapter 9
Ver. 2.001	Nov 2020	Various updates	**Ver. 3.001**	Nov 2023	Updated “Maximum output voltage” in Chapters 4.2.1, 4.2.2, 4.2.3
Ver. 2.002	Nov 2020	Various updates	**Ver 3.002**	Dec 2023	Updated drawings in sections 5.4, 6.2, 6.3, 6.6, 6.7, 7.12.1, 7.12.2, 7.12.3, 7.12.4
Ver. 2.003	Sept 2021	Various updates	**Ver. 3.003**	Jan 2024	Added Thermal Pads (section 5.4) and fixed drawing in section 7.4
Ver. 2.004	Nov 2021	Various updates			
Ver. 2.005	Mar 2022	Update			
Ver. 2.006	Mar 2022	Update			

Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Platinum Quad.

For a comprehensive specification and detailed description of the functions, refer to the MAN-P-Quartet Hardware Manual.

Chapter 2: Safety Information

The Platinum family of servo drives supports Functional Safety. This will be implemented in the Platinum Quad at a future time.

In order to achieve the optimum, safe operation of the Platinum Quad, it is imperative that you implement the safety procedures included in this installation guide. This information is provided to protect you and to keep your work area safe when operating the Platinum Quad and accompanying equipment.

Please read this chapter carefully before you begin the installation process.

Before you start, ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

Only qualified personnel may install, adjust, maintain and repair the servo drive. A qualified person has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating motors.

The Platinum Quad contains electrostatic-sensitive components that can be damaged if handled incorrectly. To prevent any electrostatic damage, avoid contact with highly insulating materials, such as plastic film and synthetic fabrics. Place the product on a conductive surface and ground yourself in order to discharge any possible static electricity build-up.

To avoid any potential hazards that may cause severe personal injury or damage to the product during operation, keep all covers and cabinet doors shut.

The following safety symbols are used in this and all Elmo Motion Control manuals:

Warning:
This information is needed to avoid a safety hazard, which might cause bodily injury or death as a result of incorrect operation.

Hot Surface Warning:
To alert against surfaces that may reach high temperatures. The heatsink and wires may reach high temperatures.

Caution:
This information is necessary to prevent bodily injury, damage to the product or to other equipment.

Important:
Identifies information that is critical for successful application and understanding of the product.

The following symbols are used in this document:

Note:
Information critical to the understanding and\or operating the feature.

Tip:
Information that helps understanding a feature, is good practice or a possible different way of action.

2.1 Warnings

- To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the servo drive while the power source is on.
- Power cables can carry a high voltage, even when the motor is not in motion. Disconnect the Platinum Quad from all voltage sources before servicing.
- The high voltage products within the Platinum Line range contain grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- All connectors except STO operating at voltage greater than ELV, require an isolation for working voltage 170VDC.

2.2 Cautions

- The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- When connecting the Platinum Quad to an approved isolated control power supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Platinum Quad, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.
- Make sure that the Safe Torque Off is operational.

2.3 CE Marking Conformance

The Platinum Quad is intended for incorporation in a machine or end product. The actual end product must comply with all safety aspects of the relevant requirements of the European Safety of Machinery Directive 2006/42/EC as amended, and with those of the most recent versions of standards EN 60204-1 and EN ISO 12100 at the least, and in accordance with 2006/95/EC.

Concerning electrical equipment designed for use within certain voltage limits, the Platinum Quad meets the provisions outlined in 2006/95/EC. The party responsible for ensuring that the equipment meets the limits required by EMC regulations is the manufacturer of the end product.

2.4 Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All Elmo drives are warranted for a period of 12 months from the time of installation, or 12 months from time of shipment, whichever comes first. No other warranties expressed or implied — and including a warranty of merchantability and fitness for a particular purpose — extend beyond this warranty.

Chapter 3: Product Description

The Platinum Quad is an integrated solution delivering up to **8000 W of continuous power** in a compact package (95.0 x 65.0 x 22.0 mm or 3.74" x 2.56" x 0.87"). The Platinum Quad is designed to be mounted on a PCB by soldering its pins directly to the PCB.

This advanced, high power density servo drive provides top performance, Functional Safety, advanced networking as well as a fully featured motion controller and local intelligence.

The Platinum Quad is provided in the following configuration:

- **Servo drive with STO Only** – The servo drive configuration supports only STO.

The Platinum Quad is powered by a single 14 V – 95 V isolated DC power source (not included) and a “smart” control-supply algorithm enables the drive to operate up to 95 V with only one power supply for nonfunctional safety, with no need for a Control power supply. The Control power supply is usually required for the logic.

The drive can operate as a stand-alone device or as part of a multi-axis system in a distributed configuration on a real-time network.

The Platinum Quad drive is easily set up and tuned using Elmo Application Studio (EASII) software tools now available in both 32bit and 64bit versions. As part of the Platinum product line, it is fully programmable with the Elmo motion control language. For more about software tools refer to the Elmo Application Studio Inline-Help.

The Platinum Quad is available in a variety of options. There are multiple power rating options, two different communications options, a variety of feedback selections and I/O configuration possibilities.

Chapter 4: Technical Information

4.1 Physical Specification

Feature	Units	All Types
Weight	g (oz.)	~140g (4.94 oz)
Dimension	mm (in)	95 x 65 x 22 mm(3.74" x 2.56" x 0.87")
Mounting method		Pin Based Module

4.2 Technical Data

The following tables describe the technical data for the Platinum Quad per axis.

4.2.1 100V Models

Feature	Units	1/100	3/100	6/100	10/100	15/100	25/100	P50/100
Minimum supply voltage	VDC	10						
Nominal supply voltage	VDC	85						
Maximum supply voltage	VDC	95						
Maximum continuous power output	W	70	220	440	735	1100	2000	2000
Efficiency at rated power (at nominal conditions)	%	> 99						
Maximum output voltage		Up to 96% of DC bus voltage						
Amplitude sinusoidal/DC continuous current	A	1	3	6	10	15	25	25
Sinusoidal continuous RMS current limit (Ic)	A	0.7	2.1	4.2	7.1	10	17.7	17.7
Peak current limit	A	2 x Ic						
Peak Time	Secs	Standard 3secs						Up to 30secs

Table 1: Power Rating for 100V Models

4.2.2 200V Models

Feature	Units	3/200	6/200	10/200
Minimum supply voltage	VDC	20		
Nominal supply voltage	VDC	170		
Maximum supply voltage	VDC	195		
Maximum continuous power output	W	440	880	1450
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		Up to 96% of DC bus voltage		
Amplitude sinusoidal/DC continuous current	A	1	6	10
Sinusoidal continuous RMS current limit (Ic)	A	2.1	4.2	7.1
Peak current limit	A	2 x Ic		

Table 2: Power Rating for 200V Models

4.2.3 R Type Models

Feature	Units	R15/200	R35/200
Minimum supply voltage	VDC	20	
Nominal supply voltage	VDC	170	
Maximum supply voltage	VDC	195	
Maximum continuous power output	W*	2200	5100
Efficiency at rated power (at nominal conditions)	%	> 99	
Maximum output voltage		Up to 96% of DC bus voltage	
Amplitude sinusoidal/DC continuous current	A	15	35
Sinusoidal continuous RMS current limit (Ic)	A	10.6	24.8
Peak current limit	A	Ic	

Table 3: Power Rating for R Type Models

Note (on current ratings):
The current ratings of the Platinum Quad are given in units of DC amperes (ratings that are used for trapezoidal commutation or DC motors). The RMS (sinusoidal commutation) value is the DC value divided by 1.41.

Note (*) Total output power allowed for all axes up to 8000W.

4.2.4 Control Supply

Feature		Unit	Details
Control supply input voltage		V	**Isolated DC source:** 14 to 95
24V Control supply input power consumption	Without encoder	W	≤4
	With 4 x 300mA encoders (1.2A@5VE)	W	≤11.5

4.2.5 4-Axis & 6-Axis Motor Phase Connections

For the 4-Axis Motor connections, four Brushless motors can be connected. Each motor uses 3-Phases.

For the 6-Axis Motor connections, six DC Brush motors can be connected. Each motor uses 2-Phases.

The following table describes the basic motor connections. For details refer to the section 7.5 Motor Power (J16, J17, J18, J19) Per Axis.

PQUA_Phases	4-Axis Motors		6-Axis Motors	
Axis1_M1	√	**Motor 1**	√	**Motor 1**
Axis1_M2	√		√	
Axis1_M3	√		√	**Motor 2**
Axis2_M1	√	**Motor 2**	√	
Axis2_M2	√		√	**Motor 3**
Axis2_M3	√		√	
Axis3_M1	√	**Motor 3**	√	**Motor 4**
Axis3_M2	√		√	
Axis3_M3	√		√	**Motor 5**
Axis4_M1	√	**Motor 4**	√	
Axis4_M2	√		√	**Motor 6**
Axis4_M3	√		√	

4.2.6 Encoder Supply

Feature	Details
5V supply	5V ±5% Up to 1.2A

4.2.7 Product Features

4.2.7.1 General Product Features

Main Feature	Details	Presence and No.
Feedback	Standard Ports A and B feedbacks Supports Incremental encoder, Absolute serial and analog encoders	**4 Axes x Standard Ports A and B feedbacks**
Communication Option	USB	**√**
	EtherCAT with Address Switches option	**√**
	LAN	**√**
	RS-232 TTL level	**√**
Analog Input	Single Ended, 0 ÷ 3.3V	**√ one per axis**

4.2.7.2 IO Features

Main Feature	Details	Presence and No.
STO	TTL	**√** 2 Isolated STOs per axis – STO1, STO2 related to STO_RET
Digital Input	TTL	**√** 1 input TTL level per axis (with option for serial extension for more inputs)
Digital Output	TTL	**√** 1 output TTL level per axis (with option for serial extension for more outputs)

4.3 Environmental Conditions

You can guarantee the safe operation of the Platinum Quad by ensuring that it is installed in an appropriate environment. The Functional Safety of the servo drive is certified according to the environmental conditions in the following table.

Warning:
During operation the Platinum Quad becomes hot to the touch (the heatsink and wires may heat up to 85 °C). Care should be taken when handling it.

Feature	Details
Operating ambient temperature	0 °C to 55 °C (32 °F to 131 °F) **Remark:** Functional Safety is applicable to the above operating temperature.
Storage temperature	-40 °C to +85 °C (-40 °F to +185 °F)
Maximum non-condensing humidity according to IEC60068-2-78	95%
Maximum Operating Altitude	2,000 m (6562 feet) It should be noted that servo drives capable of higher operating altitudes are available on request.
Mechanical Shock according to IEC60068-2-27	15g / 11ms Half Sine
Vibration according to IEC60068-2-6	5 Hz ≤ f ≤ 10 Hz: ±10mm 10 Hz ≤ f ≤ 57 Hz: 4G 57 Hz ≤ f ≤ 500 Hz:5G

4.4 Standards and Certifications

4.4.1 Functional Safety for STO

Standard	Item
IEC 61800-5-2:2017	Adjustable speed electrical power drive systems – Safety requirements – Functional
EN ISO 13849-1:2015	Safety of machinery — Safety-related parts of control systems.
EN 61508-1:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems
EN 61508-2:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems
EN 61508-3:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems

4.4.2 Electrical Safety

Specification	Details
IEC/EN 61800-5-1:2007/AMD1: 2016 **IEC/EN 61800-5-1:2007/A1: 2017**	Adjustable speed electrical power drive systems Part 5-1: Safety requirements – Electrical, thermal and energy
In compliance with **UL 61800-5-1**	Adjustable speed electrical power drive systems: Safety requirements – Electrical, thermal and energy
In compliance with **CSA C22.2 NO. 274-17**	Adjustable speed drives

4.4.3 Electromagnetic Compatibility

Specification	Details
EN 61800-3:2004/A1:2011	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
EN 61800-5-2: 2017 **Annex E**	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional

4.4.4 Environmental

Specification	Details
IEC60068-2-78	Damp heat, steady state
IEC60068-2-6	Vibration (sinusoidal)
IEC60068-2-2	Dry heat
IEC60068-2-27	Shock
IEC60068-2-1	Cold Test

4.4.5 Other Compliant Standards

For other compliant standards refer to the
Platinum Safety Drive Manual Section 22.5 or refer to the Elmo website:

https://www.elmomc.com/capabilities/standards-compliance/platinum-family/

4.4.6 Dual Use

No export license is required for the Platinum Line products signified with the suffix Q in the Part Number.

The operating frequency of the Platinum Line products is “factory limited” to ≤ 599 Hz, and therefore complies with the EU Dual Use Regulation 428/2009, 3A225, and the US Dual Use regulation EAR ECCN# 3A225.

This statement applies to all identical specimens and will become invalid if a change is made in the firmware.

Chapter 5: Installation

The Platinum Quad must be installed in a suitable environment and properly connected to its voltage supplies and the motor.

5.1 Unpacking the Drive Components

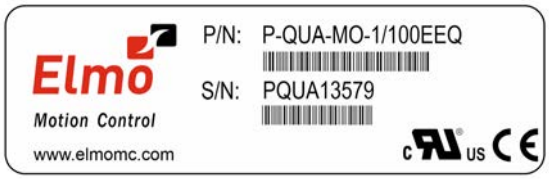
Before you begin working with the Platinum Quad, verify that you have all of its components, as follows:

- The Platinum Quad servo drive
- The Elmo Application Studio (EASII) software

The Platinum Quad is shipped in a cardboard box with Styrofoam protection.

To unpack the Platinum Quad:

1. Carefully remove the servo drive from the box and the Styrofoam.
2. Check the drive to ensure that there is no visible damage to the instrument. If any damage has occurred, report it immediately to the carrier that delivered your drive.
3. To ensure that the Platinum Quad you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Platinum Quad. It looks like this:



P-QUAD-004E

4. Verify that the Platinum Quad type is the one that you ordered and ensure that the voltage meets your specific requirements.
   The part number at the top provides the type designation. Refer to the appropriate part number in the section Catalog Number at the beginning of the installation guide.

5.2 Over-Current and Short-Circuit Protection

A serial fuse or circuit breaker should be installed Rated for drive's continuous power**.**

PQUA–Mz-zXXX/YYYzzzQ XXX = rated continues current [A]	Fuse	Circuit Breaker
1, 3, 6, 10, 15, 25 / 100V	Fast Acting Class J	DC Medium
P50 / 100V	Fast Acting Class J	DC Medium
3, 6, 10, R15, R35 / 200V	Fast Acting Class J	DC Medium
Rated short - circuit breaking capacity 5kA		

PL/CL protection: Peak and Continues Limitation

The peak current of servo drive limit for a given application is programmed to the parameter **PL[1]** amperes.
PL[1]: Value for peak current limit protection. Please refer to the "Platinum Administrative Guide".

5.3 Motor Overload Protection

The Platinum Quad supports Electronic Motor Overload protection as required by IEC-61800-5-1 with the exception of thermal memory retention and speed sensitivity.

5.4 Mounting Thermal Pads

Note: **When designing the interface board, keep the thermal pad areas (18x25mm) free of components for optimal heat dissipation.**

To better absorb the heat from the surface of the Platinum Quad, make sure the pads are covering the areas showing in the diagram, see Figure 1.

To mount the thermal pads onto the Platinum Quad:

1. Remove the backing of the thermal pad (Part Number: IMT-PQUA03) to reveal the glue side.
2. Place one thermal pad on one of the areas shown in the diagram of the Platinum Quad. See Figure 1.
3. Slightly press the pad down, but not completely, to allow for movement.
4. Align the pad and press down completely.
5. Repeat the procedure for the second pad.

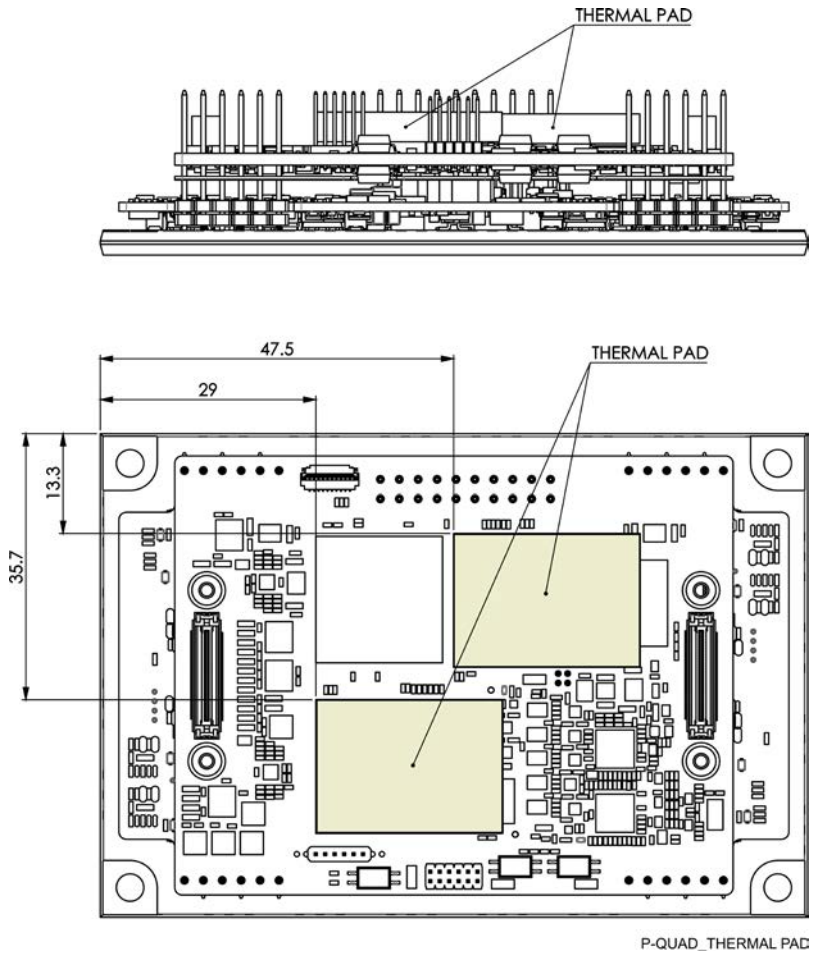


Figure 1: Aligning the thermal pads

Note: The thermal pads should contain at least the following parameters:

- Thermal Conductivity of: 3.15 W/m.K
- Hardness (Shore OO): 5
- Thickness: 4.0mm.

5.5 Mounting the Platinum Quad

The Platinum Quad was designed for mounting on a printed circuit board (PCB) via 1.27 mm pitch 0.41 mm square pins and 2.54 mm pitch 0.51 mm square pins. When integrating the Platinum Quad into a device, be sure to leave about 1 cm (0.4") outward from the heat-sink to enable free air convection around the drive. We recommend that the Platinum Quad be soldered directly to the board. Alternatively, though this is not recommended, the Platinum Quad can be attached to socket connectors mounted on the PCB.

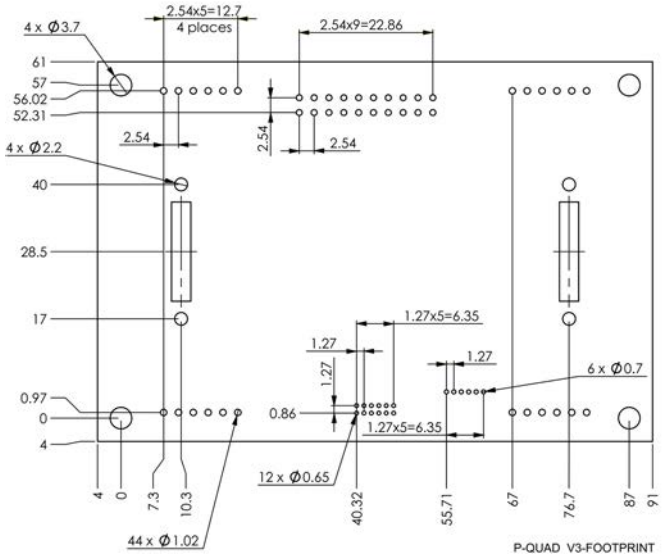


Figure 2: Platinum Quad Pin Dimensions

When the Platinum Quad is not connected to a metal chassis, the application's thermal profile may require a solution for heat dissipation due to insufficient air convection. In this case, we recommend that you connect an external heat sink.

If the Platinum Quad is enclosed in a metal chassis, we recommend that the Platinum Quad be screw-mounted to it to help with heat dissipation. The Platinum Quad has screw-mount holes on each corner of the heat-sink for this purpose – see below. Use 4 x M3 x 8 mm screws to mount the Platinum Quad onto a surface to a force of 0.4 Nm torque for each screw.

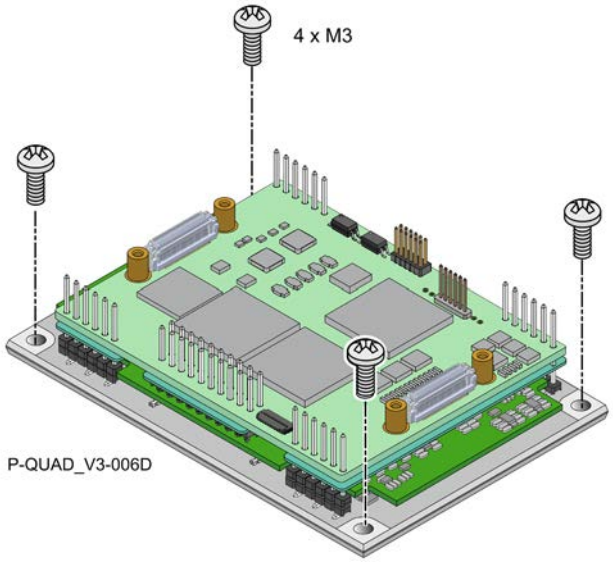


Figure 3: Mounting the Platinum Quad

Chapter 6: Connections

6.1 Connectors

Throughout this document, all Ax connections refer to the specific axis "x", numbered from 1…6.

The Platinum Quad has eight connectors.

Port	No. Pins	Type	Function
J15	20	2.54 mm pitch	Main and Control Power
J16	6	2.54 mm pitch	Motor A1 phases
J17	6	2.54 mm pitch	Motor A2 phases
J18	6	2.54 mm pitch	Motor A4 phases
J19	6	2.54 mm pitch	Motor A3 phases
J6	60	0.4 mm pitch	Port A, Port B Feedback and I/O
J7	60	0.4 mm pitch	Communication, I/O, and HALL
J27	6	1.27 mm pitch	Aux RS-232 and 3.3V
J29	12	1.27 mm pitch	STO

6.2 Pinout Locations

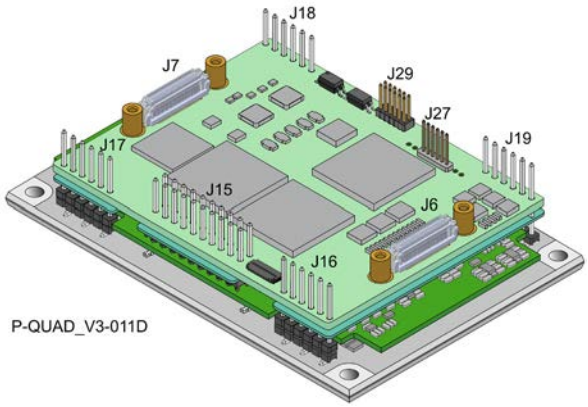


Figure 4: Connectors and Connector Locations

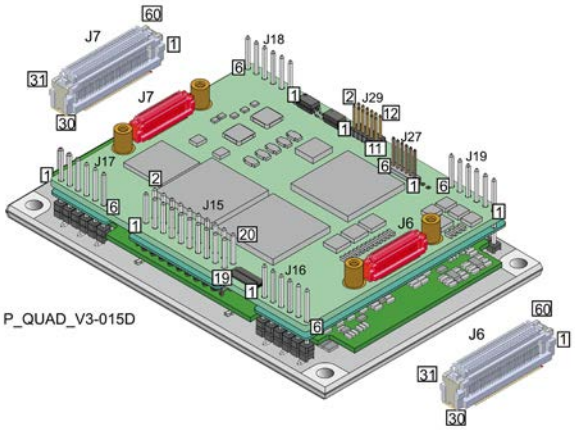


Figure 5: Connectors and Pinout Locations

Table 4: Connector Types

The pinouts in Table 8: STO Pin Assignments
Wiring describe the function of each pin in the Platinum Quad connectors listed in Table 4.

6.3 Motor Power Connector Pinouts (J16, J17, J18, J19)

The following table describes the pinouts for the Motor Power connectors J16 (Motor M1), J17 (Motor M2), J19 (Motor M3), and J18 (Motor M4).

Pins No.	Pin Signal	Function	Wires	
			Brushless Motor	Brushed DC Motor
5,6	M3	Motor phase	Motor	Motor
3,4	M2	Motor phase	Motor	Motor
1,2	M1	Motor phase	Motor	No Connection
Pin Positions				

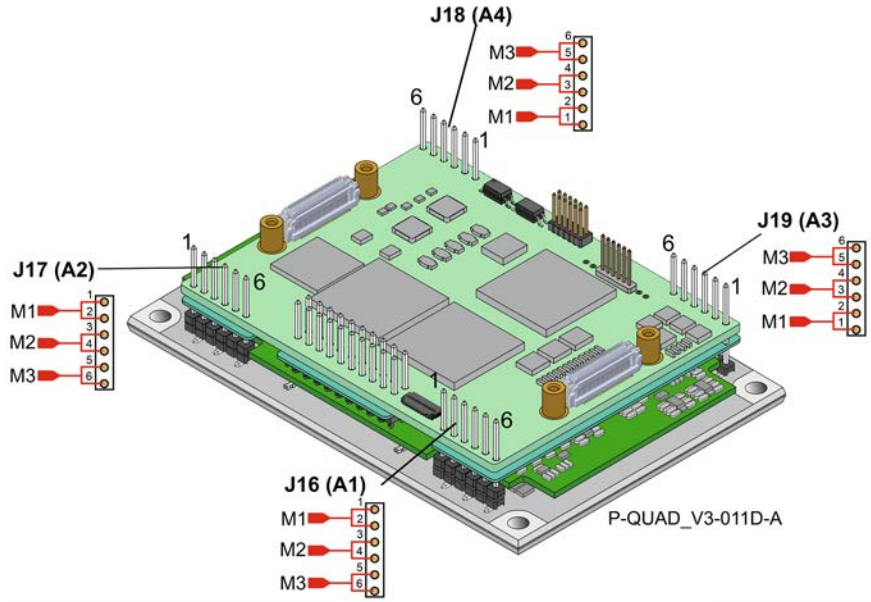


Table 5: Main Power and Motor Connections

6.4 Main Power and Control Power Pinouts (J15)

Pins (J15)	Signal	Function
1	COMRET	Common Return
2	5VE	Encoder +5V Supply
3	PR	Power Return
4	PR	Power Return
5	PR	Power Return
6	PR	Power Return
7	PR	Power Return
8	PR	Power Return
9	PR	Power Return
10	PR	Power Return
11	VP+	Positive Power Input
12	VP+	Positive Power Input
13	VP+	Positive Power Input
14	VP+	Positive Power Input
15	VP+	Positive Power Input
16	VP+	Positive Power Input
17	VP+	Positive Power Input
18	VP+	Positive Power Input
19	VL	VL Input
20	PE	Protective Earth
Pin Positions		

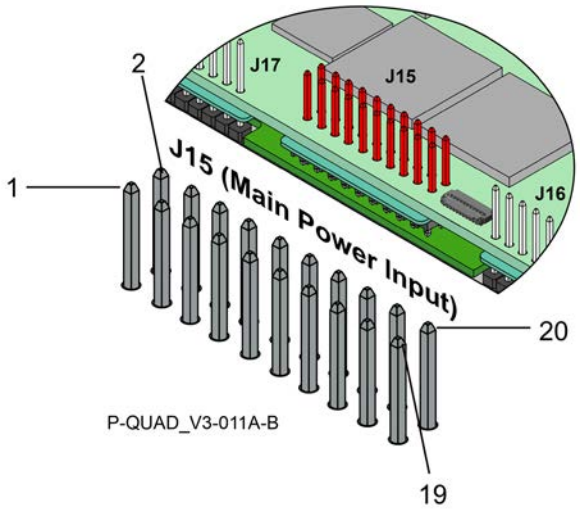


Table 6: Main Power and Motor Connections

6.5 Aux RS-232 and 3.3V Pinouts (J27)

Pins (J27)	Signal	Function
1	+3.3V	3.3 V supply voltage
2	COMRET	Common Return
3	RS232_TX	Auxiliary RS232 Transmit
4	RS232_RX	Auxiliary RS232 Receive
5	Reserved	
6	Reserved	
Pin Positions		

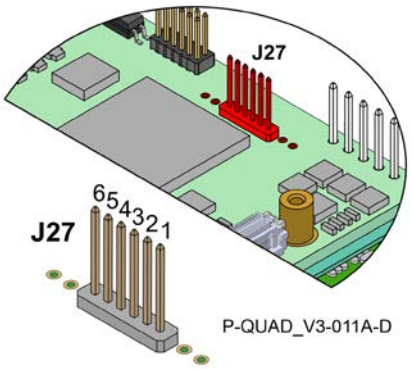


Table 7: Control Supply Pins

6.6 Port A, Port B Feedback and I/O Pinouts (J6)

The following tables describe the J6 pinouts for the Port A, Port B Feedbacks and I/Os. The connection diagrams are shown in section 7.8 Feedbacks.

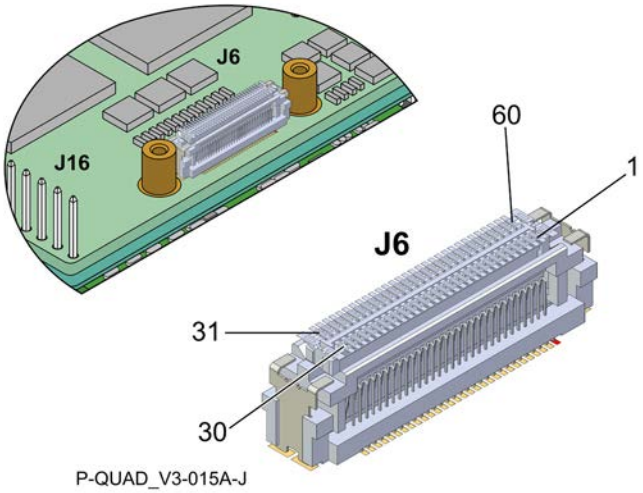


Figure 6: J6 - Port A, Port B Feedback and I/O Pinouts

6.6.1 LEDs, COMRET, General Purpose IO

For a comprehensive specification and detailed description of the functions, refer to the MAN-P-Quartet Hardware Manual**.**

Pin LEDs, COMRET, & GPIO		
	Signal	**Function**
7	COMRET	Common return (5V Return)
20	LED1	Bi-color indication output 1 (Cathode), Drive Status
21	LED_ET_RUN	LED Status EtherCAT RUN
22	LED_ET_ERR	LED Status EtherCAT ERR
31	SB_CLOCK	Serial Bus Clock (9.375Mhz) for extended I/O 10KΩ Pull Up is needed. (Refer to the Platinum Extended IO Application Note)
32	SB_LOAD	Serial Bus Load for extended I/O. √ (refer to the Platinum Extended IO Application Note)
33	SB_OUT	Serial Bus output for extended I/O. 10KΩ Pull Down is needed. (refer to the Platinum Extended IO Application Note)
34	SB_IN	Serial Bus input for extended I/O (refer to the Platinum Extended IO Application Note)
35	SB_OUT_ENn	Serial Bus enable for extended I/O (refer to the Platinum Extended IO Application Note)
36	ETHERNET_SPEED	Ethernet Speed LED
37	LED2	Bi-color indication output 2 (Cathode) , Drive Status
38	COMRET	Common return (5V Return)

6.6.2 Port A

Pin Port A Axis A1		Incremental Encoder	Absolute Serial Encoder
	Signal	**Function**	**Function**
27	PortA_B-	Channel B -	Absolute encoder data-
28	PortA_B+	Channel B+	Absolute encoder data+
29	PortA_A-	Channel A -	Absolute encoder clock-
30	PortA_A+	Channel A +	Absolute encoder clock+
39	PortA_INDEX+	Channel_Index+	
40	PortA_INDEX-	Channel_Index-	

Pin Port A Axis A2		Incremental Encoder	Absolute Serial Encoder
	Signal	**Function**	**Function**
10	PortA_INDEX-	Channel_Index-	
11	PortA_INDEX+	Channel_Index+	
16	PortA_B-	Channel B -	Absolute encoder data-
17	PortA_B+	Channel B+	Absolute encoder data+
18	PortA_A-	Channel A -	Absolute encoder clock-
19	PortA_A+	Channel A +	Absolute encoder clock+

Pin Port A Axis A3		Incremental Encoder	Absolute Serial Encoder
	Signal	**Function**	**Function**
3	PortA_B-	Channel B -	Absolute encoder data –
4	PortA_B+	Channel B+	Absolute encoder data+
5	PortA_A-	Channel A -	Absolute encoder clock-
6	PortA_A+	Channel A +	Absolute encoder clock+
57	PortA_INDEX-	Channel_Index-	
58	PortA_INDEX+	Channel_Index+	

Pin Port A Axis A4		Incremental Encoder	Absolute Serial Encoder
	Signal	Function	Function
45	PortA_INDEX-	Channel_Index-	
46	PortA_INDEX+	Channel_Index+	
51	PortA_B-	Channel B -	Absolute encoder data –
52	PortA_B+	Channel B+	Absolute encoder data+
53	PortA_A-	Channel A -	Absolute encoder clock-
54	PortA_A+	Channel A +	Absolute encoder clock+

6.6.3 Port B

Pin Port B Axis A1		Incremental Encoder	Interpolated Analog Encoder
	Signal	Function	Function
23	PortB_B-	Channel B-	Cosine-
24	PortB_B+	Channel B+	Cosine+
25	PortB_A-	Channel A -	Sine-
26	PortB_A+	Channel A+	Sine+
41	PortB_INDEX+	Channel_Index+	Analog_Index+
42	PortB_INDEX-	Channel_Index-	Analog_Index-

Pin Port B Axis A2		Incremental Encoder	Interpolated Analog Encoder
	Signal	Function	Function
8	PortB_INDEX-	Channel_Index-	Analog_Index-
9	PortB_INDEX+	Channel_Index+	Analog_Index+
12	PortB_B-	Channel B-	Cosine-
13	PortB_B+	Channel B+	Cosine+
14	PortB_A-	Channel A -	Sine-
15	PortB_A+	Channel A+	Sine+

Pin Port B Axis A3		Incremental Encoder	Interpolated Analog Encoder
	Signal	**Function**	**Function**
1	PortB_A-	Channel A -	Sine-
2	PortB_A+	Channel A+	Sine+
55	PortB_INDEX-	Channel_Index-	Analog_Index-
56	PortB_INDEX+	Channel_Index+	Analog_Index+
59	PortB_B-	Channel B-	Cosine-
60	PortB_B+	Channel B+	Cosine+

Pin Port B Axis A4		Incremental Encoder	Interpolated Analog Encoder
	Signal	**Function**	**Function**
43	PortB_INDEX-	Channel_Index-	Analog_Index-
44	PortB_INDEX+	Channel_Index+	Analog_Index+
47	PortB_B-	Channel B-	Cosine-
48	PortB_B+	Channel B+	Cosine+
49	PortB_A-	Channel A -	Sine-
50	PortB_A+	Channel A+	Sine+

6.7 Communication, I/O, and HALL Pinouts (J7)

The following drawing and tables describe the J7 pinouts for the Communication, I/Os, and HALLs.

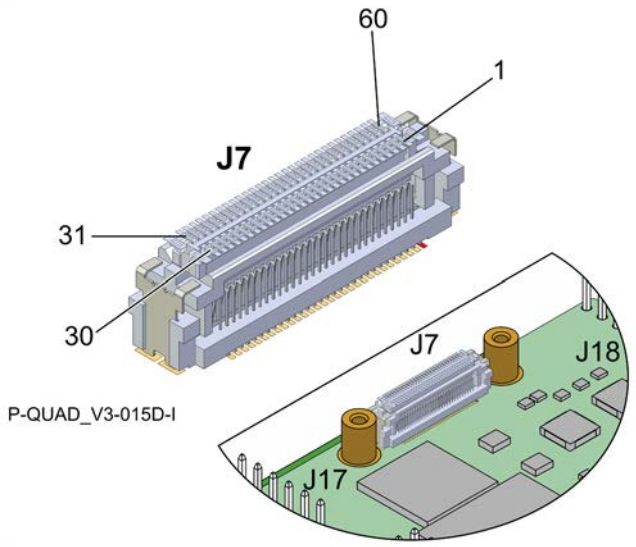


Figure 7: Communication, IO, and HALL Pinouts

6.7.1 Analog Input

Pins	Analog Input	
J7	**Signal**	**Function**
1	AIN_A4	Single ended analog input for Axis 4, 0 ÷ 3.3V
2	AIN_A3	Single ended analog input for Axis 3, 0 ÷ 3.3V
3	AIN_A2	Single ended analog input for Axis 2, 0 ÷ 3.3V
4	AIN_A1	Single ended analog input for Axis 1, 0 ÷ 3.3V

6.7.2 COMRET

Pins	COMRET, PE	
J7	**Signal**	**Function**
8	COMRET	Common return
48	COMRET	Common return
51	COMRET	Common return
54	COMRET	Common return

6.7.3 Halls Port A & B Feedback

Pins	Halls	
J7	**Signal**	**Function**
11	HC_A4	Hall C Input for Axes 4
12	HB_A4	Hall B Input for Axes 4

Pins	Halls	
13	HA_A4	Hall A Input for Axes 4
14	HC_A3	Hall C Input for Axes 3
15	HB_A3	Hall B Input for Axes 3
16	HA_A3	Hall A Input for Axes 3
17	HC_A2	Hall C Input for Axes 2
18	HB_A2	Hall B Input for Axes 2
19	HA_A2	Hall A Input for Axes 2
20	HC_A1	Hall C Input for Axes 1
21	HB_A1	Hall B Input for Axes 1
22	HA_A1	Hall A Input for Axes 1

6.7.4 EtherCAT

Pins	EtherCAT	
	Signal	Function
46	PHY_OUT_RX+	EtherCAT OUT Receive +
47	PHY_OUT_RX-	EtherCAT OUT Receive -
49	PHY_OUT_TX+	EtherCAT OUT Transmit +
50	PHY_OUT_TX-	EtherCAT OUT Transmit -
52	PHY_IN_RX+	EtherCAT In receive+
53	PHY_IN_RX-	EtherCAT In receive-
55	PHY_IN_TX+	EtherCAT In transmit+
56	PHY_IN_TX-	EtherCAT In transmit-
57	PHY_IN_LINK_ACT	EtherCAT In active LED
58	PHY_OUT_LINK_ACT	EtherCAT out active LED

6.7.5 LAN

Pins	Ethernet	
	Signal	Function
5	ETHERNET_LINK	Ethernet Link LED
6	PHY_RX-	Ethernet Out receive-
7	PHY_RX+	Ethernet Out receive+
9	PHY_TX-	Ethernet Out transmit-
10	PHY_TX+	Ethernet Out transmit+

6.7.6 General Purpose

Pins	General Purpose	
J7	**Signal**	**Function**
23	A4_DOUT	Digital Output for Axes 4. 10KΩ Pull Down is needed.
24	A3_DOUT	Digital Output for Axes 3. 10KΩ Pull Down is needed.
25	A2_DOUT	Digital Output for Axes 2. 10KΩ Pull Down is needed.
26	A1_DOUT	Digital Output for Axes 1. 10KΩ Pull Down is needed.
27	A4_DIN	Digital input for Axes 4
28	A3_DIN	Digital input for Axes 3
29	A2_DIN	Digital input for Axes 2
30	A1_DIN	Digital input for Axes 1

6.7.7 USB

Pins	USB	
J7	**Signal**	**Function**
31	USBD+	USB _P line
32	USBD-	USB _N line
33	USB VBUS	USB VBUS 5 V Input

6.7.8 RS-232

Pins	RS-232	
J7	**Signal**	**Function**
59	RS232_RX	TTL RS232 receive
60	RS232_TX	TTL RS232 transmit

6.8 STO (J29)

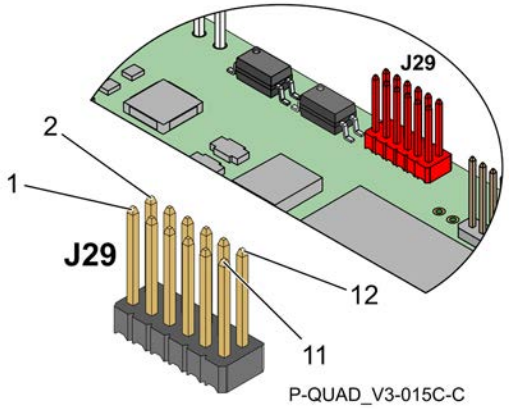
Pins	STO	
	Signal	**Function**
1	STO1	STO1 input, opto isolated from control (COMRET) for Axis 1
2	STO1	STO1 input, opto isolated from control (COMRET) for Axis 3
3	STO2	STO2 input, opto isolated from control (COMRET) for Axis 1
4	STO2	STO2 input, opto isolated from control (COMRET) for Axis 3
5	STO_RET	STO signal return for Axis 1. (The two digital STO inputs are optically isolated from the other parts of the drive and share one return line.)
6	STO_RET	STO signal return for Axis 3. (The two digital STO inputs are optically isolated from the other parts of the drive and share one return line.)
7	STO1	STO1 input, opto isolated from control (COMRET) for Axis 2
8	STO1	STO1 input, opto isolated from control (COMRET) for Axis 4
9	STO2	STO2 input, opto isolated from control (COMRET) for Axis 2
10	STO2	STO2 input, opto isolated from control (COMRET) for Axis 4
11	STO_RET	STO signal return for Axis 2. (The two digital STO inputs are optically isolated from the other parts of the drive and share one return line.)
12	STO_RET	STO signal return for Axis 4. (The two digital STO inputs are optically isolated from the other parts of the drive, and share one return line.)
Pin Positions		
		

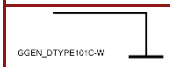
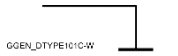
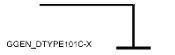
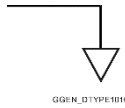
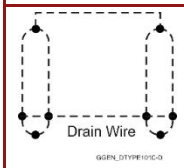
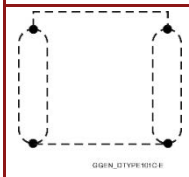
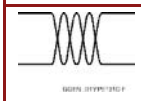
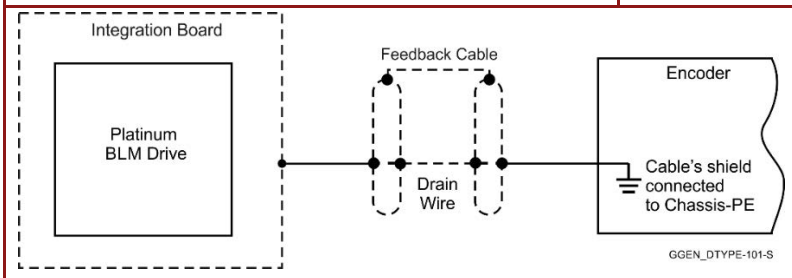
Table 8: STO Pin Assignments

Chapter 7: Wiring

7.1 Wiring legend

Once the product is mounted, you are ready to wire the device. Proper wiring, grounding and shielding are essential for ensuring safe, immune and optimal servo performance of the drive.

The following table legend describes the wiring symbols detailed in all installation guides.

Wiring Symbol	Description
	Earth connection (PE)
	**User Side:** This symbol signifies that any type of grounding may be used on the user side
	VDD Return
	Isolated Ground
	Power Return
	COMRET Common at the Drive
	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
	Shielded cable braid only, without drain wire.
	Twisted-pair wires
	Encoder Earthing. The cable`s shield is connected to the chassis (PE) in the connector. The servo drive shield is connected to Earth.

7.2 The Platinum Quad Connection Diagram

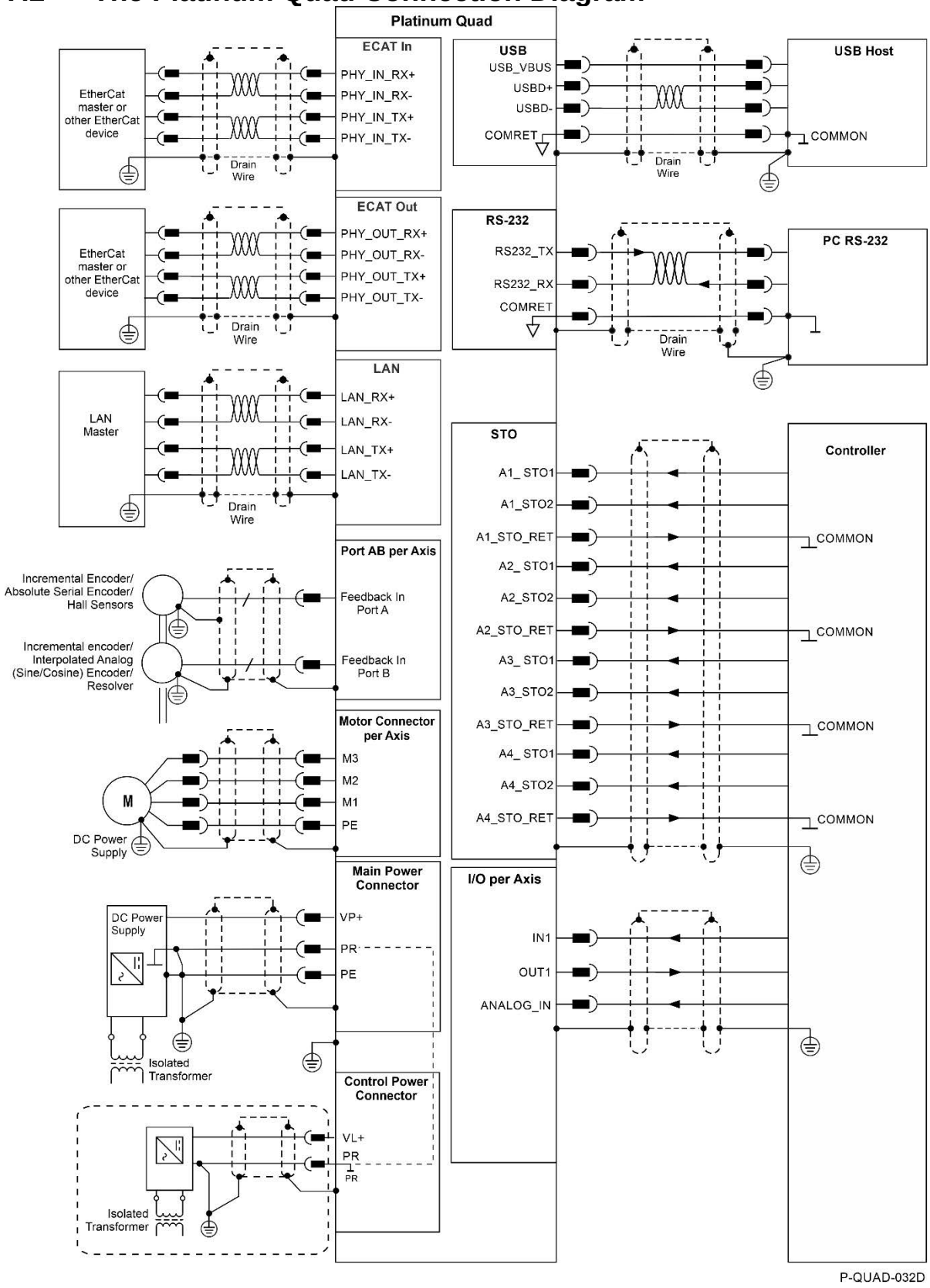


Figure 8: The Platinum Quad Connection Diagram

7.3 Integrating the Platinum Quad on a PCB

For a comprehensive specification and detailed description of the functions, refer to the MAN-P-Quartet Hardware Manual.

The Platinum Quad is designed to be mounted on a PCB by soldering its pins directly to the PCB. Refer to Chapter 13 in the MAN-P-Quartet Hardware Manual for further information.

7.3.1 Power Returns (PR)

In the Platinum Quad, the power stage and control stage are internally connected, and the negative node of the DC power bus is designated as PR.

The maximum realistic Power Return is achieved using a plane, which connects between the Platinum Drive and the power source. The impedance on this plane must be as low as possible to reduce the impedance between the "Grounds". This effectively reduces the levels of common mode differences, interferences, EMI, etc.

7.3.2 COMRET

For details of the COMRET, refer to section 13.1.4 in the MAN-P-Quartet Hardware Manual.

7.3.3 Earth Connection (PE)

The PE (Earth connection) terminal is connected internally in the drive to the Platinum Quad's chassis (heat-sink + metal cover) which serves as an EMI common plane. Any other assembly metallic parts (such as the chassis) should also be connected to the PE.

Under normal operating conditions, the PE trace carries no current. The only time these traces carry current is under unusual conditions (such as when the device has become a potential shock or fire hazard while conducting external EMI interferences directly to ground). When connected properly the PE trace prevents these hazards from affecting the drive.

7.3.4 Power Return (PR), Common Return (COMRET) and Earth Connections (PE)

Safety regulations (UL61800-5-1, IEC61800-5-1, and UL508C) require that the servo drive, as a "stand alone", must withstand breakdown voltages of 2KV for the 200V models, and 1.7KV for the 100V models, between PE to PR. However, the connections between PE to PR and the COMRET are essential for the safe operation of the servo drive. Therefore, the following topology must be used:

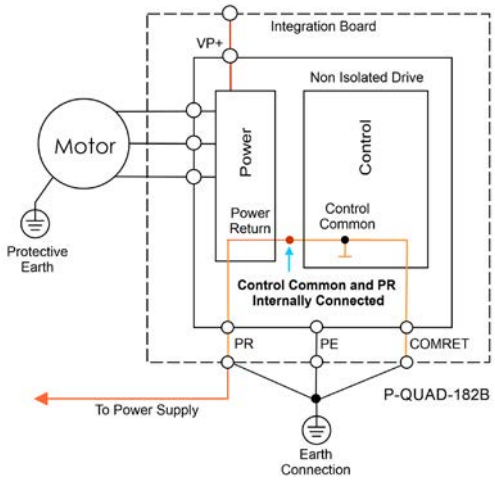


Figure 9: Platinum Quad Earth Connections

The connections to PE are essential but must be done externally to the integration board.
The COMRET should be connected to the PR in the Integration Board.

7.4 Power Conductors PCB layout

For a comprehensive specification and detailed description of the functions, refer to section 13.2 in the MAN-P-Quartet Hardware Manual**.**

The PCB is virtually divided into two zones: Power Zone, and Control & Communication Zone.

- **Power Zone**
  This area is dedicated to Power conductors only: VP+, PR, PE, VL+, and motor leads.
- **Control and Communication Zone**
  This area of the PCB is dedicated to Control low level signals.

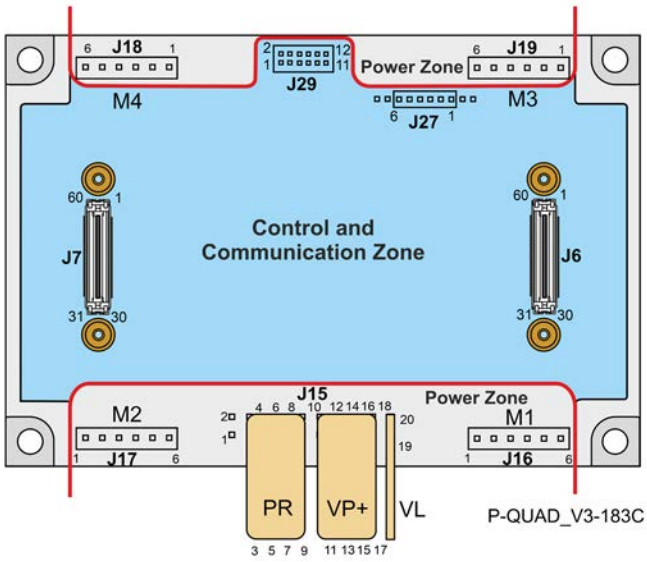


Figure 10: Platinum Quad Power Conductors PCB layout

For more details, refer to section 13.3 in the MAN-P-Quartet Hardware Manual**.**

7.5 Motor Power (J16, J17, J18, J19) Per Axis

When connecting the Platinum Quad to several similar motors, all should be wired in an identical manner. This will enable the same settings to run on all drives.

For Motor connections to 4-Axes (Figure 11) or 6-Axis (Figure 12), use the following connection diagrams and procedure per axis, depending on the motor type.

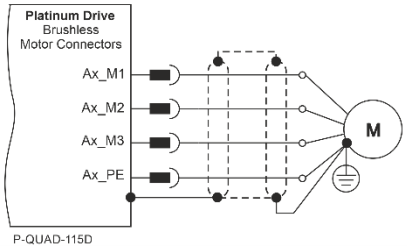


Figure 11: 4-Axis Brushless Motor Power Connection Diagram

To connect the motor power per axis:

6. Ensure that the motor chassis is properly earthed.
7. Connect the appropriate wire from the Motor Power cables to the M1, M2, M3, and PE terminals on the Platinum Quad.
   Make sure not to bundle the wires.
8. The phase connection is arbitrary as Elmo Application Studio (EAS II) will establish the proper commutation automatically during setup. When tuning a number of drives, you can copy the setup file to the other drives and thus avoid tuning each drive separately. In this case the motor-phase order must be the same as on the first drive.
9. For high EMI environment, it is highly recommended to use a 4-wire shielded (not twisted) cable for the motor connection. The gauge is determined by the actual RMS current consumption of the motor.
10. Connect the cable shield to the closest ground connection at the motor end.
    For better EMI performance, the shield should be connected to Earth Connection (heat sink mounting holes).

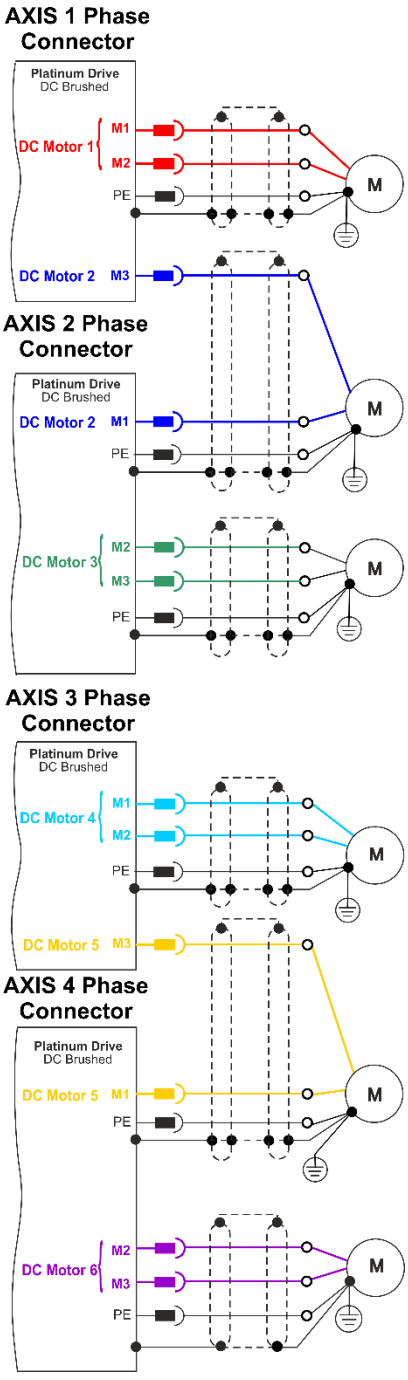


Figure 12: 6-Axis Brushed Motor Power Connection Diagram

7.6 Main and Control Power (J15)

The Platinum Quad receives power from Main and Control supplies and delivers power to the motor.

7.6.1 Main Supply

There are two possible power ratings for the Platinum Quad:

- 100V is for the 10 to 95 VDC
- 200V is for the 20 to 195 VDC
- **For power rating 200 V**
  Two DC power sources are required, a DC power source of 14 to 195 V isolated from the Mains, and a control supply 14-95 V (isolated from the Mains) for the logic.
- **For power rating of 100 V**
  Only a single DC Power source of 14 to 95 VDC isolated from the Mains, is required for the main power and also for the control power. However, a control power supply can be added for the logic.

Note: Both the 14 V to 95 V and 14 V to 195 V DC power sources must be isolated from the Mains.

Connect the DC power source cable to the VP+ and PR terminals on the main power connector.

To connect the main power:

1. The DC power supply source must be isolated from the Mains.
2. For best immunity, it is highly recommended to use shielded (not twisted) cables for the DC power source. A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the motor.
3. Connect the cable shield to the closest earth connection near the power supply.
4. Connect the PE to the closest earth connection near the power supply.
5. Connect the PR to the closest earth connection near the power supply.
6. Before applying power, first verify the polarity of the connection.

7.6.2 Control Supply

For power rating 200 V

The Control supply 14 V to 95 V is required.

For power rating 100 V

The Control supply 14 V to 95 V can be added for the 100 V power rating.

Note: The source of the Control Supply must be isolated from the Mains.

Connect the VL+ and PR terminal to the control Connector.

To connect your integration board to the control supply:

1. The source of the control supply must be isolated from the Mains.
2. For safety reasons, connect the return (common) of the control supply source to the closest earth connection near the control supply source.
3. Connect the cable shield to the closest earth connection near the control supply source.
4. Before applying power, verify the polarity of the connection.

7.6.3 Power Supply for 200 V Power Rating

For Power Rating 200 V, two DC power sources are required; a main power 20 to 195 V DC power source isolated from the Mains, and a control supply 14 to 95 V (isolated from the Mains) for the logic. The following figure describes the connection of main power and control.

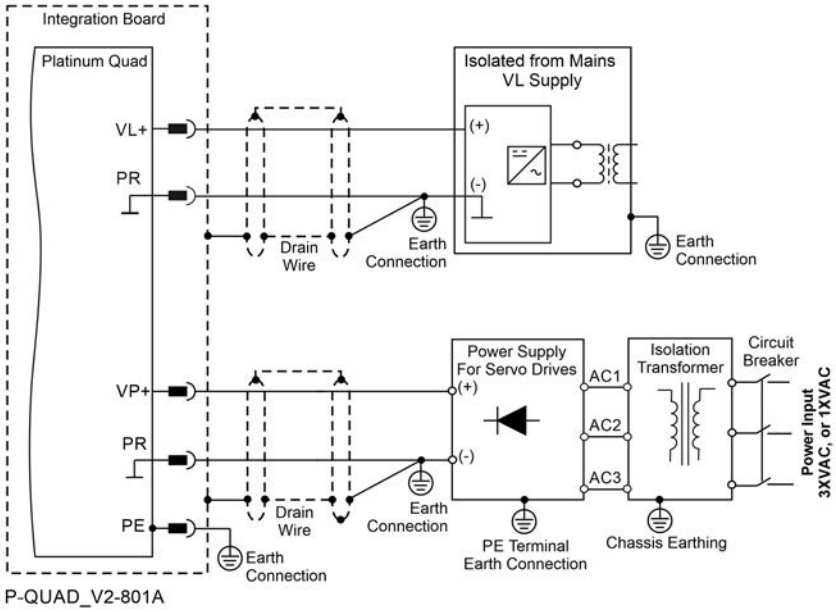


Figure 13: Power Supply Connection Diagram for Power Rating 200 V

Note:
Make sure to connect the PR to the closest earth connection near the power supply.

7.6.4 Power Supply for 100 V Power Rating

For Power Rating 100 V, two DC power sources are required; a main power 10 to 95 V DC power source isolated from the Mains, and a control supply 14 to 95 V (isolated from the Mains) for the logic. The following figure describes the connection of main power and control (Figure 14)

Important Note Regarding the INPUT CAPACITANCE:
For Platinum Quad modules <15A, a DC Bus Capacitance of **~2300uF is recommended to be** connected between the VP+ and the PR, as close as possible (10 – 20 cm) to the Platinum Quad, as shown in the following figure.

For Platinum Quad modules ≥15A, a DC Bus Capacitance of **~2300uF or more must be** connected between the VP+ and the PR, as close as possible (10 – 20 cm) to the Platinum Quad, as shown in the following figure**.**

The Elmo TAB-100 (a DC Bus connection and capacitance bank of ~2300µF) is recommended**.** Please refer to the TAB-100 Installation Guide. Alternatively, an equal or larger capacitor can be used.

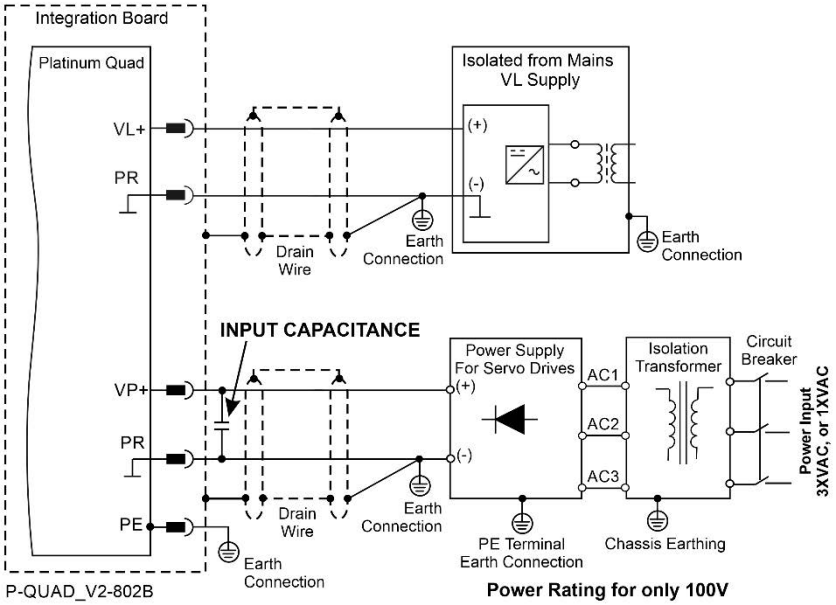


Figure 14: Shared Optional Power Supply Connection Diagram

Note: Make sure to connect the PR to the closest earth connection near the power supply.

7.7 STO (Safe Torque Off) (J29) Per Axis

7.7.1 TTL Mode – TTL Voltage Level

Refer to the diagrams below for TTL option connection.

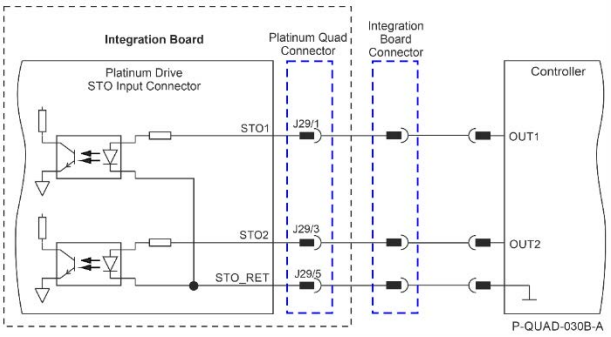


Figure 15: STO Input Connection – TTL Option for Axis 1

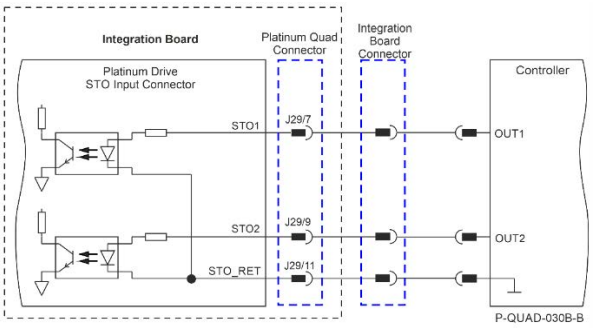


Figure 16: STO Input Connection – TTL Option for Axis 2

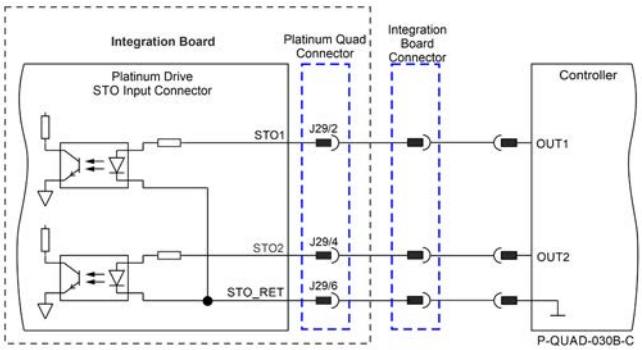


Figure 17: STO Input Connection – TTL Option for Axis 3

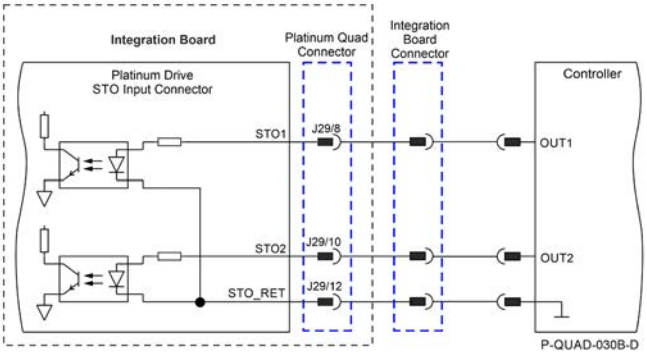


Figure 18: STO Input Connection – TTL Option for Axis 4

7.8 Feedbacks

The following connection diagrams describe the Port A and Port B feedback connections for axis A1 to A4. Each Port connection has four signals for each of the axes A1 to A4.

7.8.1 Feedback Port A (J6)

Port A supports the following sensor inputs:

- Incremental Encoder or absolute serial Encoder
- Differential pulse-width modulation (PWM) signal input
- Differential Pulse & Direction signal inputs

7.8.1.1 Incremental Encoder

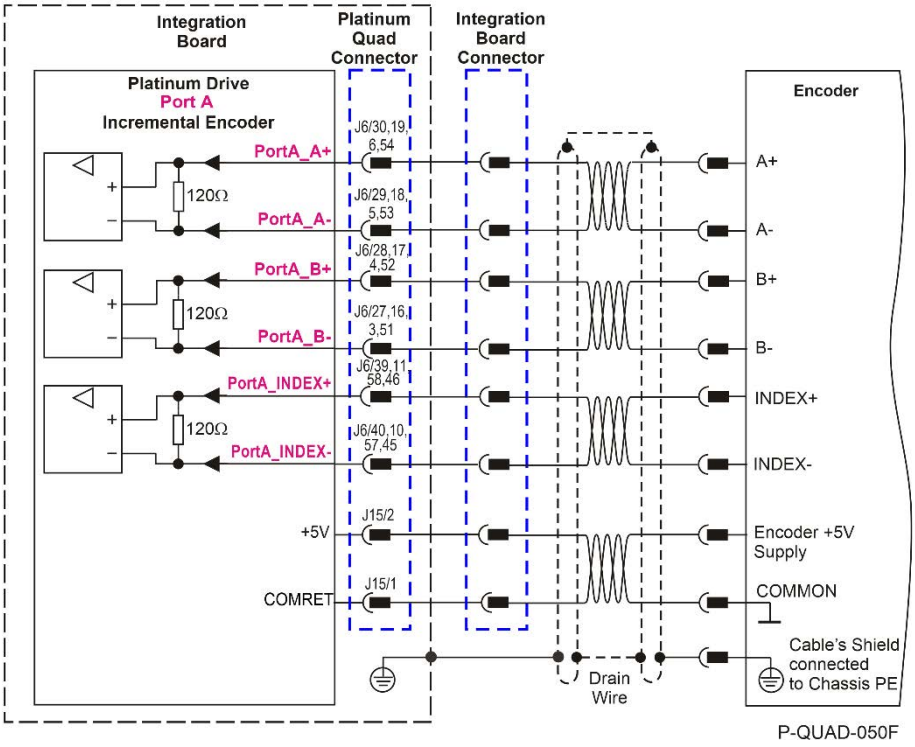


Figure 19: Port A Incremental Encoder Input – Recommended Connection Diagram

7.8.1.2 Absolute Serial Encoder

The following Absolute Encoder types are supported; EnDat 2.2, Biss C and Biss B, SSI, and Hiperface.

The following is the diagram connection of the EnDat, Biss, SSI:

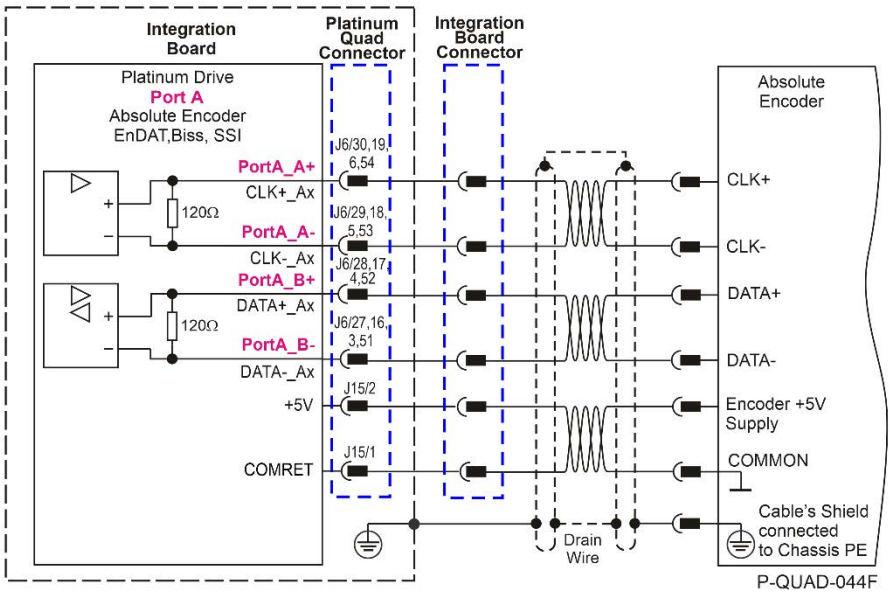


Figure 20: Absolute Serial Encoder – Recommended Connection Diagram for EnDat, Biss, SSI

7.8.1.3 Hiperface

The following figure describes the connection diagram.

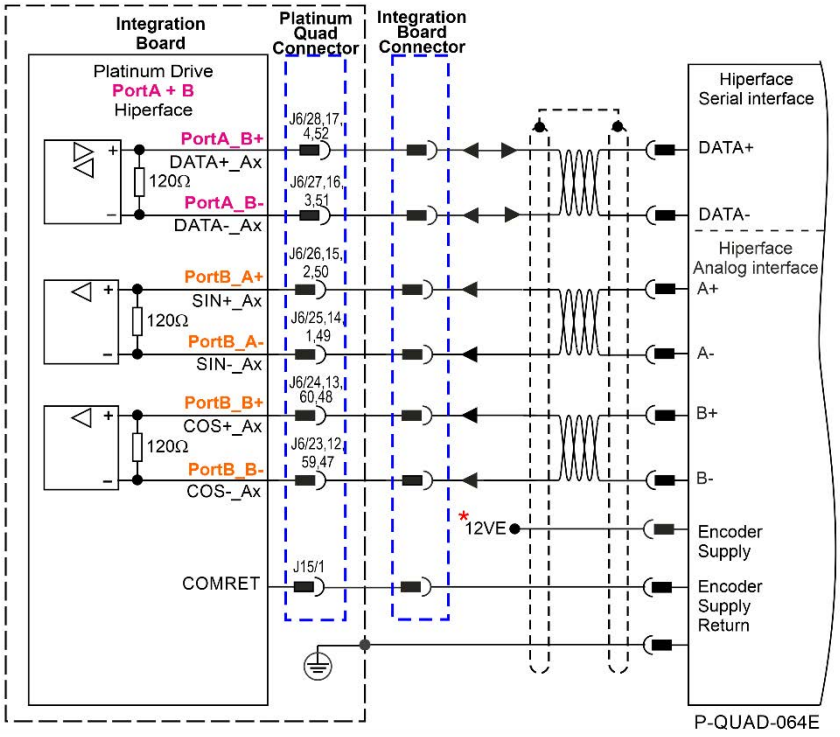


Figure 21: Absolute Serial Encoder – Recommended Connection Diagram for Stegmann Hiperface

Note: ***An external 12 V Supply is required for Hiperface**

7.8.2 Feedback Port B (J6)

Port B supports the following sensors:

- Incremental Encoder, interpolated analog Encoder or analog Hall sensors

Differential PWM signal input can be connected to port B

7.8.2.1 Incremental Encoder

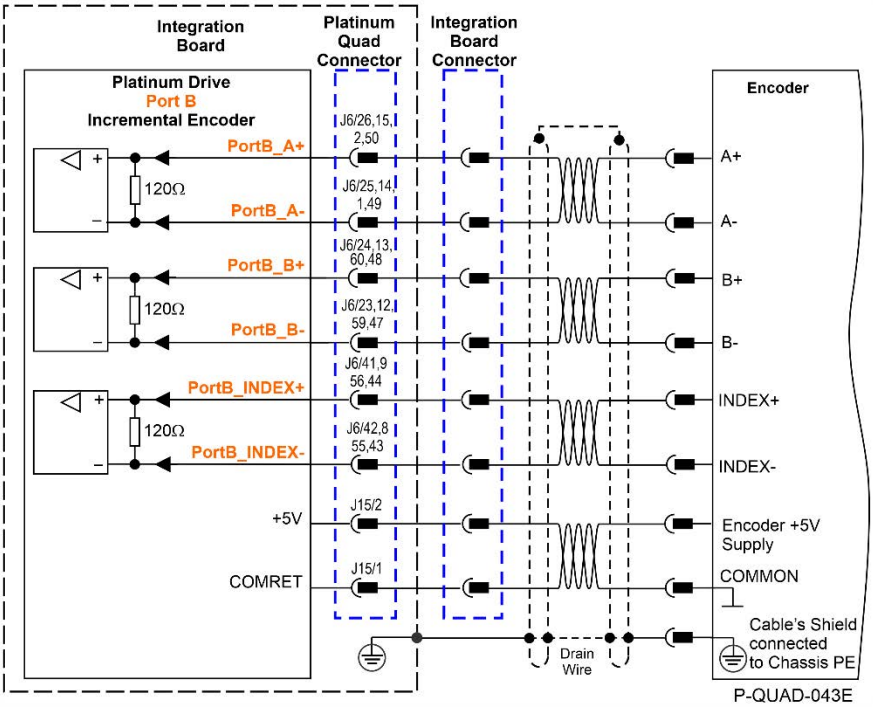


Figure 22: Port B Incremental Encoder Input – Recommended Connection Diagram

7.8.2.2 Interpolated Analog (Sine/Cosine) Encoder

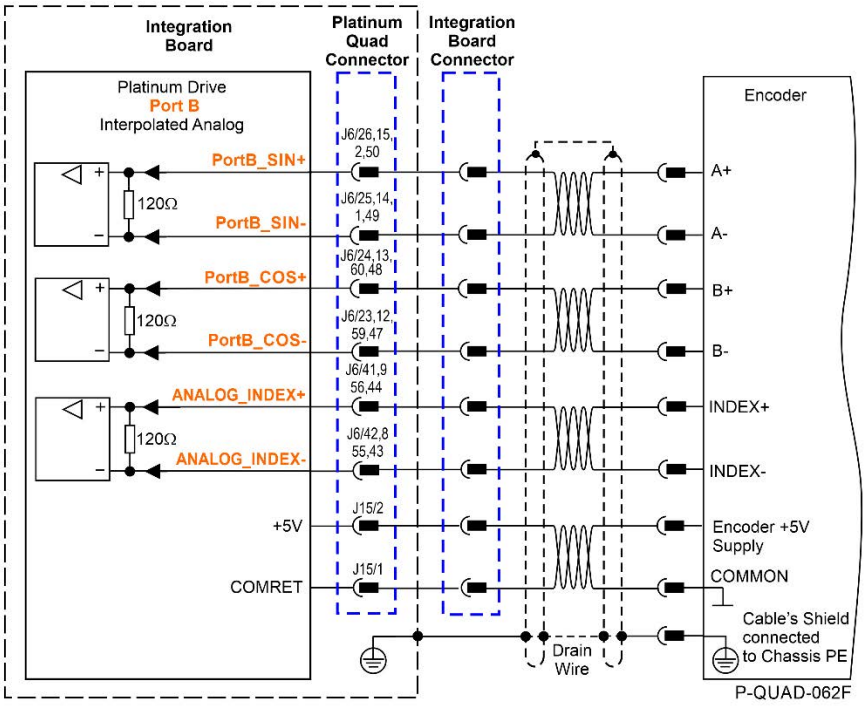


Figure 23: Port B - Interpolated Analog Encoder Connection Diagram

7.8.3 Feedback - Hall Sensors (J7)

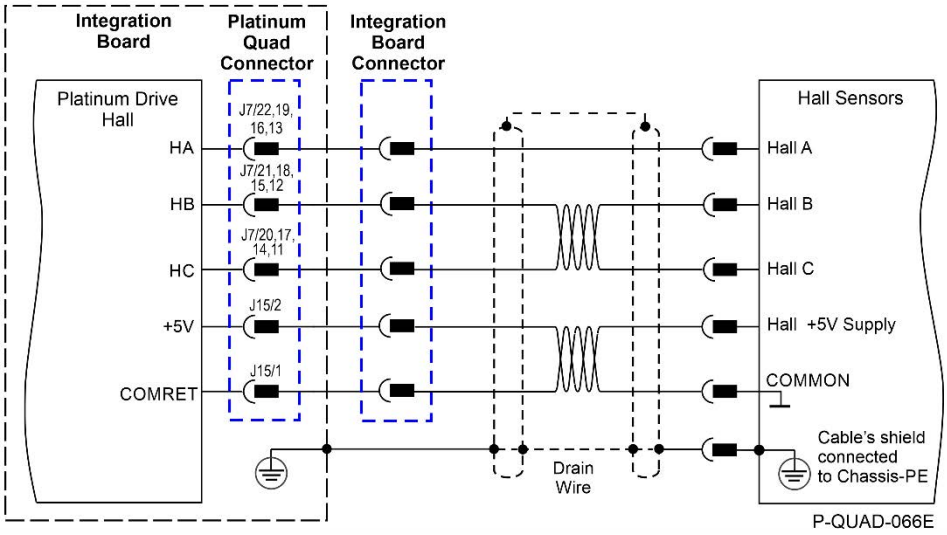


Figure 24: Hall Sensors Connection Diagram

7.9 Digital I/Os (J7)

7.9.1 Digital Inputs

The following diagram describes the connection of IN1 to IN4 to opto coupler in order to isolate the digital inputs.

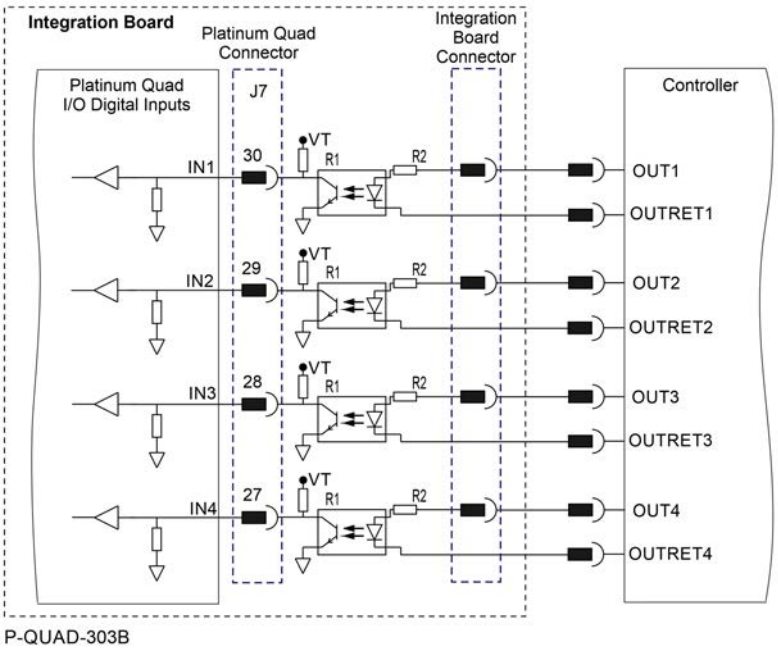


Figure 25: Digital Inputs Connection Diagram

7.9.2 Digital Outputs

The following diagram describes the connection of OUT1 to OUT4 to opto coupler in order to isolate the digital output.

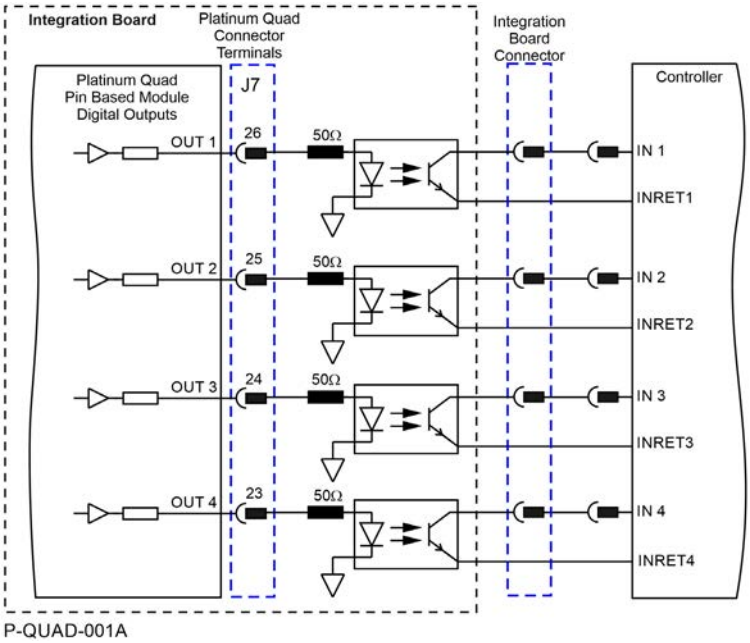


Figure 26: Digital Outputs Connection Diagram

7.10 Analog Input (J7)

The following connection diagrams describe the Analog Input connections for axis A1 to A4.

Analog Input Features	Details
Number of inputs	4
Input type	Single ended
Operating voltage range	0 ÷ 3.3V
Analog input resolution	14-bit
Sample Time	High Speed (100us, 200us, 500us) according to configuration

The following circuit describes the internal interface of the Analog input.

TBD

Figure 27: Single Ended Analog Input

7.11 Communication

The following connection diagrams describe the communication connections.

7.11.1 USB 2.0 (J7)

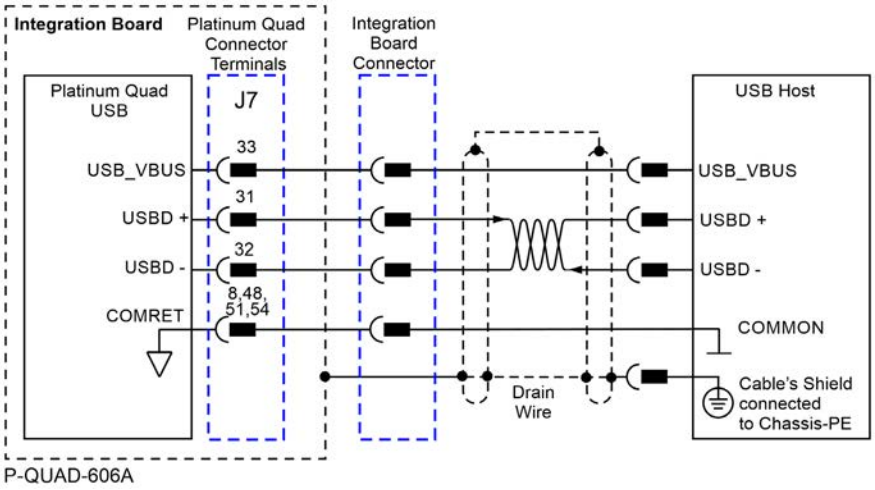


Figure 28: USB Network Diagram

7.11.2 RS-232 (J27)

The following connection diagram describes the auxiliary RS-232 interface connections.

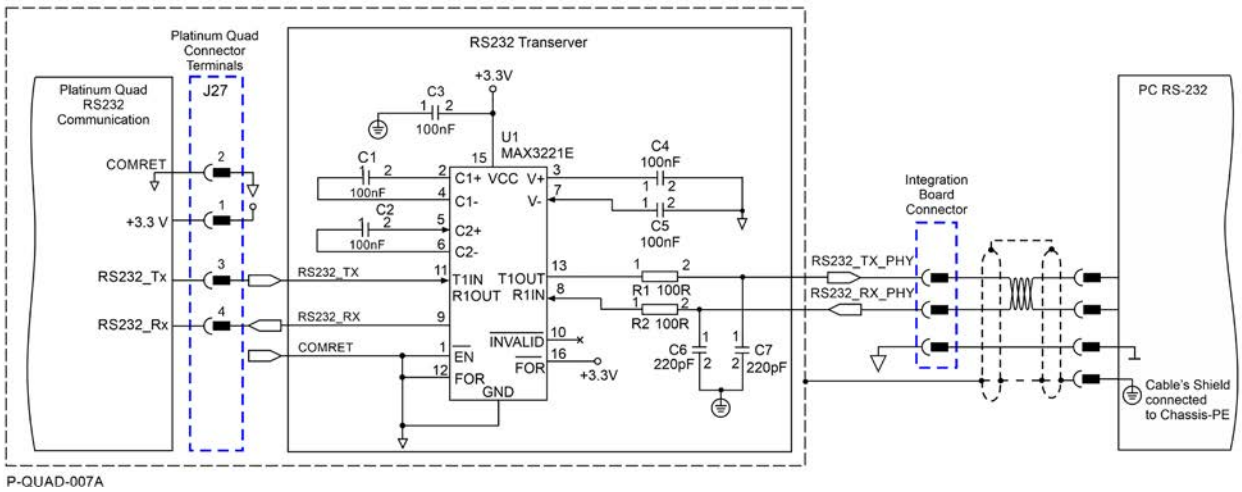


Figure 29: RS-232 Auxiliary Connection Diagram

7.11.3 RS-232 (J7)

The following connection diagram describes the main RS-232 interface connections

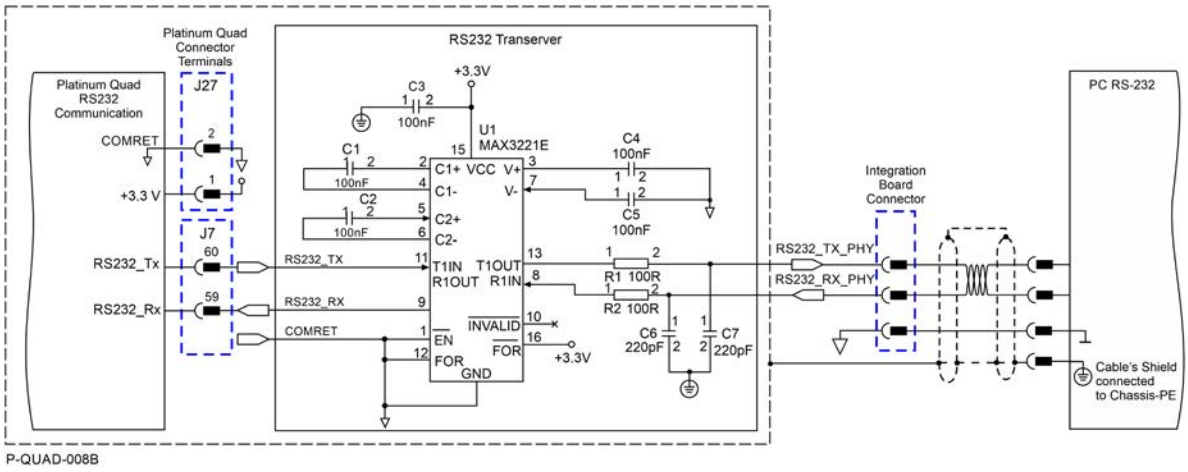


Figure 30: RS-232 Main Connections Diagram

7.11.4 EtherCAT (J7)

The Platinum Quad can serve as an EtherCAT slave device. It includes EtherCAT_IN and EtherCAT_OUT ports. It also includes LED indicators.

For details of the specification, signals and optional EtherCAT interfaces, refer to the section 12.2 EtherCAT in the MAN-P-Quartet Hardware Manual.

7.11.5 LAN (J7)

The Platinum Quad supports an Ethernet port.

For details of the specification, signals, and optional Ethernet interfaces, refer to the section 12.3 Ethernet in the MAN-P-Quartet Hardware Manual.

7.12 Drive Status, EtherCAT, and Ethernet LEDs

EtherCAT Address Switches and the LED indicators can be implemented on the user integration board.

7.12.1 Drive Status Indicator

This red/green dual LED is used for immediate indication of the following states:

- **Initiation state:** In this state the LED indicates whether the drive is in the boot state (blinking red) or in the operational state (steady red).
- **Working state:** In this state the LED indicates whether the drive is in an amplifier failure state (red) or is ready to enable the motor (green).

The Drive provides signals for Drive status indicator (Pin 20 LED 1 and Pin 37 LED 2). To install the red/green dual LED, refer to the section 13.4 Drive Status Indicator in the MAN-P-Quartet Hardware Manual.

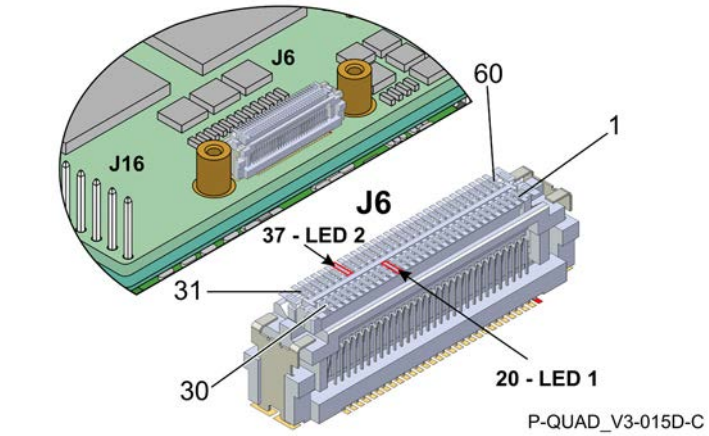


Figure 31: Drive Status LED Pins on J6 Connector

7.12.2 EtherCAT Status Indicator

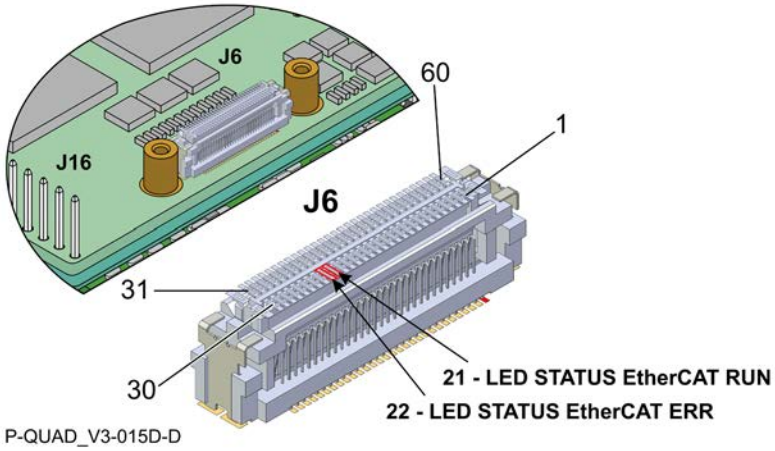


Figure 32: EtherCAT Status LED

The EtherCAT Ports have a status LED. The EtherCAT status indicator is a red/green dual LED that combines the green RUN indicator and the red ERROR indicator of the EtherCAT state machine. For further details, see the EtherCAT Application Manual.

To install the red/green dual LED, refer to the section 13.11.1.4 EtherCAT Status Indicator in the MAN-P-Quartet Hardware Manual.

7.12.3 EtherCAT Link Indicators

Each of the EtherCAT Ports also has an EtherCAT Link IN and EtherCAT Link OUT LED.

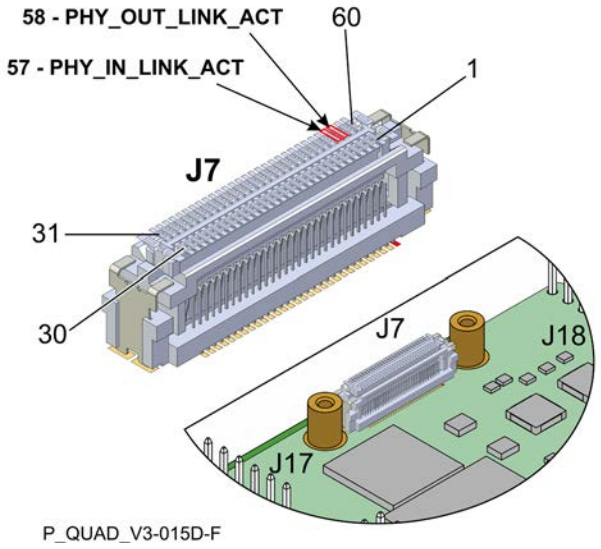


Figure 33: EtherCAT Link LEDs

The green LEDs are the link/activity indicators. They show the state of the applicable physical link and the activity on that link, both for the PHY_IN_LINK_ACT, and PHY_OUT_LINK_ACT.

LED	State	Meaning
Link /Activity	Off	No link is established.
	On	A link is established.
	Blinking	There is data transmission activity.

To install the LED indicators, refer to the section 13.10.2 EtherCAT in the MAN-P-Quartet Hardware Manual.

7.12.4 LAN Activity Indicator

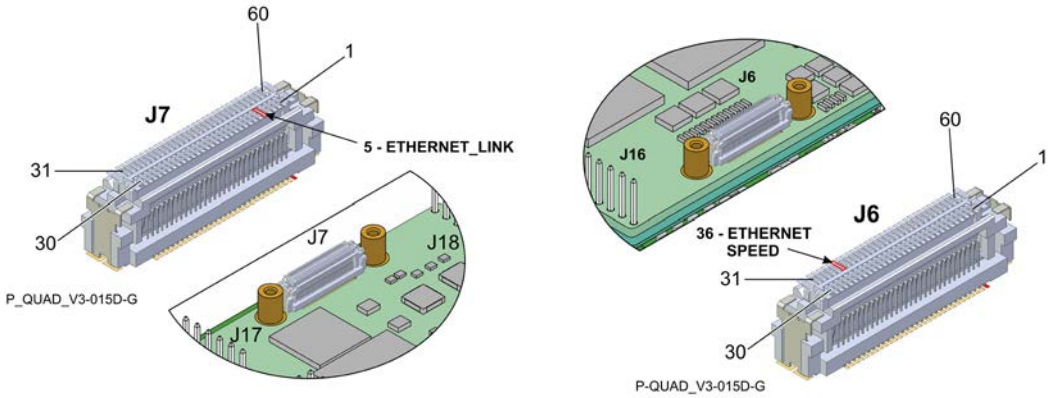


Figure 34: LAN Link and Activity LED Pins

The green LED is the link/activity indicator shows the state of the applicable physical link and the activity on that link.

The amber LED is the speed indicator shows the speed of the connection on the Ethernet line. The possible states of these LEDs are summarized in Table 9.

LED	State	Meaning
Link /Activity	Off	No link is established
	On	A link is established
	Blinking	There is data transmission activity
Speed	On	The connection speed is 100 Mbps The speed of the Ethernet line must be 100 Mbps. Otherwise, there is no Ethernet data transmission
	Off	The connection speed is 10 Mbps

Table 9: LED States

To install the LAN Activity and Speed LEDs, refer to the section LAN Link/Activity Indicators in the MAN-P-Quartet Hardware Manual.

Chapter 8: Powering Up

After the Platinum Quad is connected to its device, it is ready to be powered up.

Caution:
Before applying power, ensure that the DC supply is within the specified range and that the proper plus-minus connections are in order.

8.1 Initializing the System

After the Platinum Quad has been connected and mounted, the system must be set up and initialized. This is accomplished using the *EASII*, Elmo's Windows-based software application. Install the application and then perform setup and initialization according to the directions in the *EASII User Manual*.

8.2 Heat Dissipation

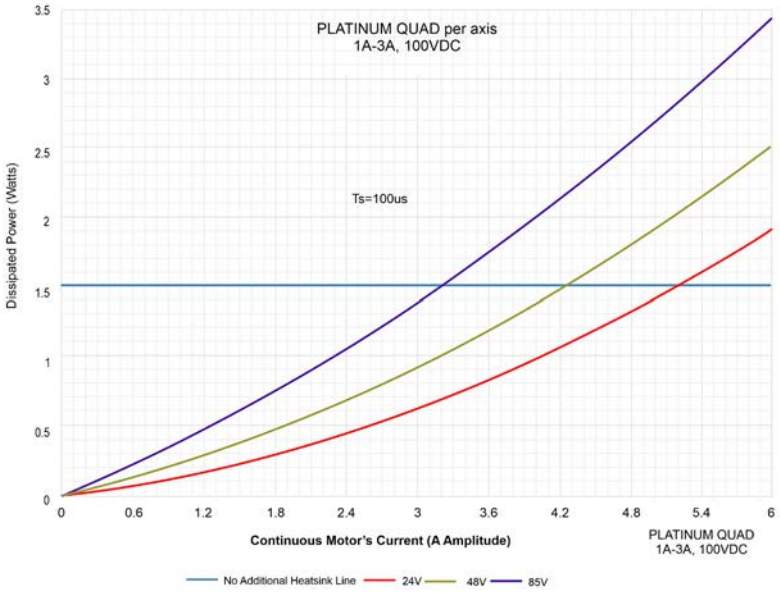
The best way to dissipate heat from the Platinum Quad is to mount it so that its heat sink faces up. For best results leave approximately 10 mm of space between the Platinum Quad's heat sink and any other assembly.

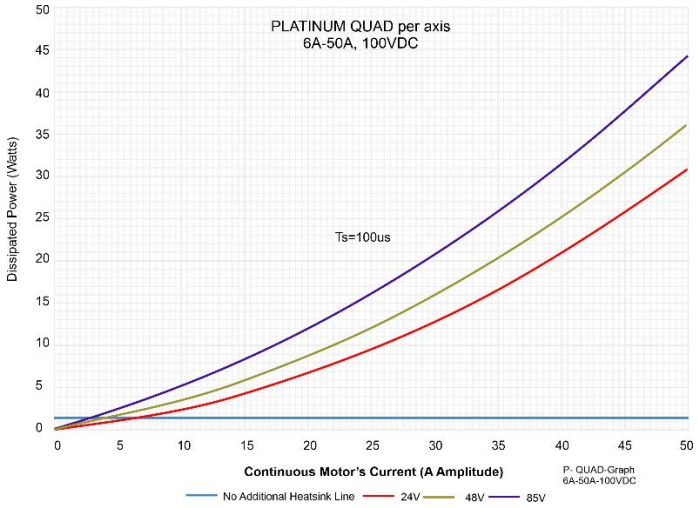
8.3 Thermal Data

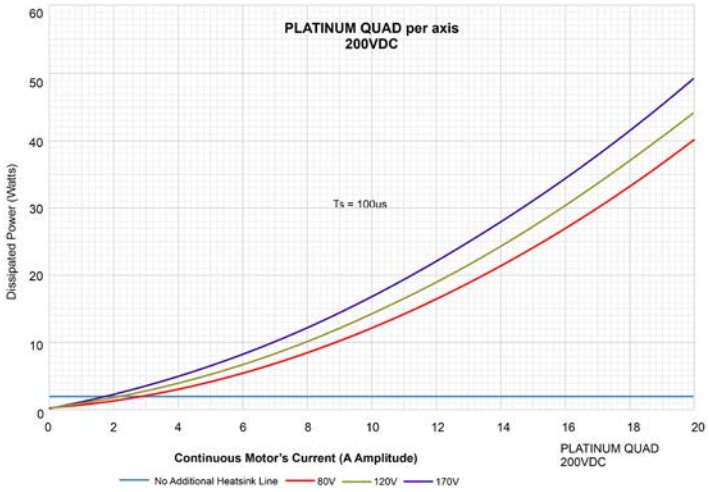
- Heat dissipation capability (θ): Approximately 10 °C/W
- Thermal time constant: Approximately 240 seconds (thermal time constant means that the Platinum Quad will reach 2/3 of its final temperature after 4 minutes)
- Shut-off temperature: 86 °C to 88 °C (measured on the heat sink)

8.4 Heat Dissipation Data Per Axis

Heat dissipation is shown graphically below:







8.5 How to Use the Charts

The charts above are based upon theoretical worst-case conditions. Actual test results show 30% to 50% better power dissipation.

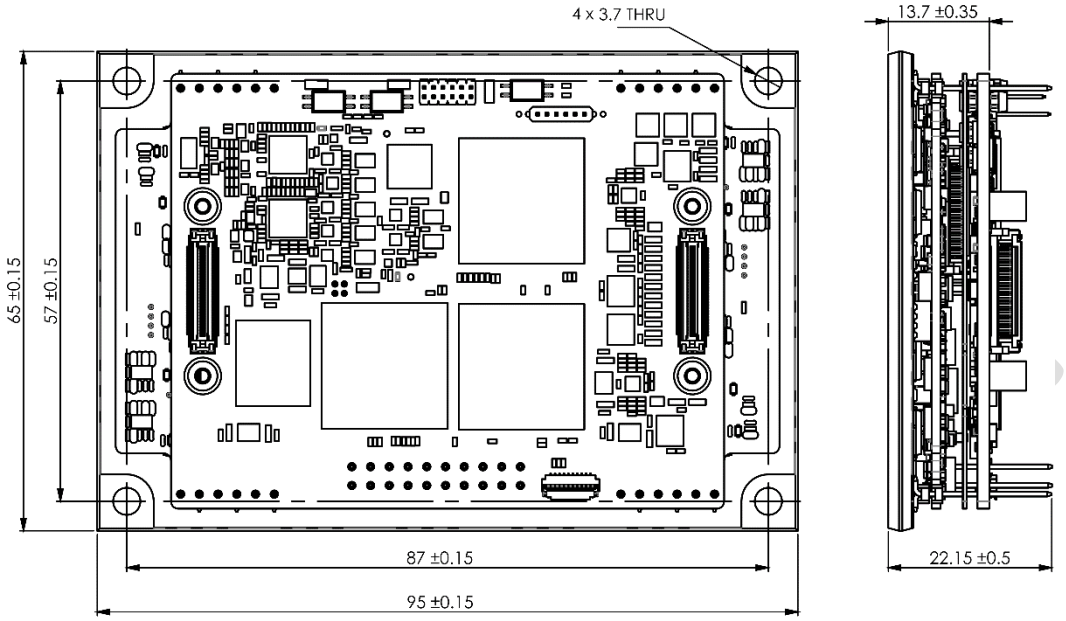
To determine if your application needs a heat sink:

1. Allow maximum heat sink temperature to be 80 °C or less.
2. Determine the ambient operating temperature of the Platinum Quad.
3. Calculate the allowable temperature increase as follows:
   For an ambient temperature of 40 °C , ΔT= 80°C – 40 °C = 40 °C
4. Use the chart to find the actual dissipation power of the drive. Follow the voltage curve to the desired output current and then find the dissipated power.
5. If the dissipated power is below 4 W the Platinum Quad will need no additional cooling.

Note:
The chart above shows that no heat sink is needed when the heat sink temperature is 80 °C, ambient temperature is 40 °C and heat dissipated is 4 Watts.

Chapter 9: Dimensions

This chapter provides detailed technical dimensions regarding the Platinum Quad.



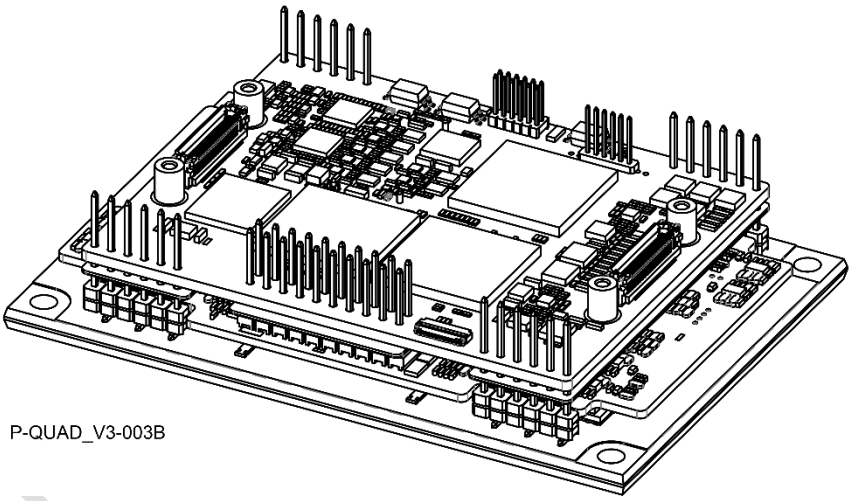


Figure 35: Platinum Quad

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